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and
AIRCRAFT ENGINEER

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The Outlook

Self-contained Power Plants

TEN years have elapsed since the Air Ministry initiated the scheme for complete aircraft power-plant units, comprising the engine, engine mounting, cooling and oil systems, engine controls, engine-driven accessories and cowlings. A year later a committee of the Society of British Aircraft Constructors worked out many of the details and laid down certain standardized arrangements. So complete was this scheme that not only could different types of liquid-cooled engines be interchanged with others of approximately the same power, but air-cooled engines could be substituted for the liquid-cooled.

It would be difficult to exaggerate the benefits which have already accrued from this purely British enterprise, and they are by no means at an end yet. In his lecture to A.F.I.T.A., delivered in Paris on December 10th, Mr. Nixon, of the Rolls-Royce firm, outlined some of the things which have been achieved. As was but natural, he dealt chiefly with the work done at Hucknall, but other British engine manufacturers can show comparable equipment and results, although possibly on a somewhat more modest scale than the 10,000 engine hours of development testing (approximately half of which in flight) done annually at Hucknall.

A study of the summary of Mr. Nixon's lecture which we publish in this issue is well worth while. After perusing it, one begins to appreciate the infinite care and thoroughness which have gone into the establishment of the Rolls-Royce reputation, not merely at home but throughout the world.

One feature which is to be particularly welcomed is the degree to which a number of engine functions are made entirely automatic. The crew of a modern aircraft has more than enough to do as it is, and in the case of the Canadian-built D.C.4M the "automaticity" of the power plants is such that no flight engineer need be carried, thus making it possible to carry an additional fare-paying passenger. Incidentally, it is surprising to learn that although the *North Star* (D.C.4M) class has only been operating some six months, it has already made more than 600 crossings of the Atlantic; we believe the actual number was 634 up to the end of November.

The complete power-plant system as applied to gas turbines will need the very closest co-operation between aircraft and engine firms, more especially in "buried" installations, which present many problems not encountered with engines that are merely "buttoned-on" the wings. The original scheme looked difficult in 1934, but it has been achieved. Doubtless equal success will be attained with gas turbines.

Theory and Practice

AVIATION history is full of examples of practice outstripping theory. In fact, flying began that way. The early experimenters knew precious little of theory (if we except the Wright brothers, who built their own wind tunnel in order to get data for design). In the main, those early machines were built "by eye," flown, crashed, repaired and flown again. The pioneers learnt the hard way.

Then came the period of transition from wood to metal construction. So long as this took the form of "translating" wood into metal, using much the same geometrical forms, no great difficulty was encountered. The stressing of a girder structure was a simple matter. But when it came to stressed-skin construction, the picture was very different. Again practice outstripped theory. The flying-boat manufacturers in particular used their native wit and produced metal hulls long before there was any accurate method of stressing them. If a planing bottom proved too weak in one boat, it was strengthened in the next. And even in landplane design

there were cases of metal skin being used before the existence of a theory to fit it.

The helicopter is a modern instance of practice being ahead of theory. The mathematicians have not yet caught up with the engineers, and the theoretical snags in helicopter designs are so formidable that if one took them very seriously one would not dare to build a helicopter. Yet helicopters are flying every day and doing good work, work which could not be done by any other vehicle, be it surface or air.

All this activity could be said to be premature, inasmuch as theoretically the helicopter is far from perfect. It may not be stable, it may be very expensive, and it may be difficult to fly. But it does fly, and it does do work that could not be done otherwise. So let us not be discouraged by the present incompleteness of helicopter theory. Theory will catch up one day, and when it does it will lead to improvements and refinements. But in the meantime, all honour to those who refuse to be daunted by the difficulties.

These ruminations should not be taken as an indication that we despise theory. Far from it. Flying would not be where it is today without theory. But theory should be regarded as a tool, a very valuable tool, not as the creative force. The time has not yet come when aircraft design is an exact science. It is still an art.

The Royal Auxiliary Air Force

GREAT satisfaction will be felt on all sides with the announcement that His Majesty has honoured the Auxiliary Air Force by conferring upon it the prefix "Royal," in recognition of its distinguished service during the war. Congratulations to the A.A.F.

The first four A.A.F. squadrons were formed in 1925, and by the time war broke out the Force numbered 20 flying squadrons and more than 40 balloon squadrons. As part of the first-line strength of the R.A.F., the A.A.F. units were called out for operational service at the outbreak of war, and in the years that followed the "week-end warriors" proved themselves no whit inferior to the regular Royal Air Force squadrons.

When the war finished, the A.A.F. squadrons were withdrawn from service with the R.A.F. and re-formed for part-time service at their pre-war bases. Initially the plan was for 13 day-fighter squadrons, three night-fighter squadrons and four light bomber squadrons; but since then all 20 have become fighter squadrons.

With the changes in operational requirements, the balloon squadrons were disbanded, and the non-flying part of the A.A.F. now comprises a number of Air Defence Units whose task would be, in any future war, to man the fighter control and radar reporting system. In addition, it was decided to form 20 Auxiliary Regiment Squadrons to undertake light anti-aircraft and ground airfield defence. These squadrons are to be based with the flying squadrons and will train them. So far, nine Air Defence Units and five Regiment Squadrons have been formed. Others will be formed next year.

While one must heartily welcome the honour which the King has shown the A.A.F., the prefix "Royal" may on occasion lead to some slight confusion in that the new initial letters are the same as those of the Royal Australian Air Force. To use R.Aux.A.F. and R.Aust.A.F. is not a pretty solution.

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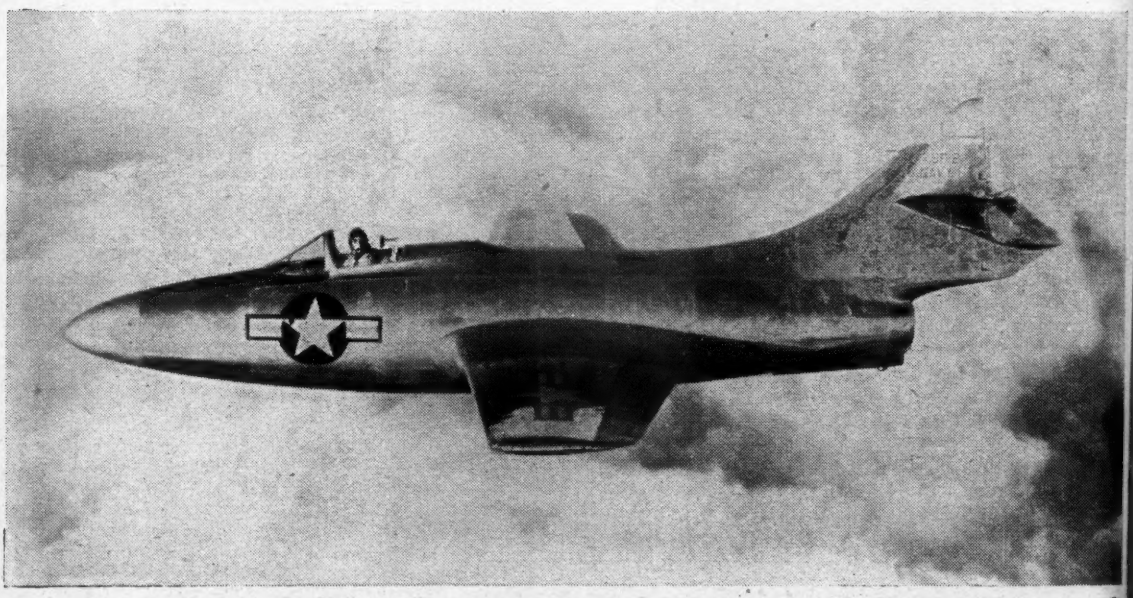
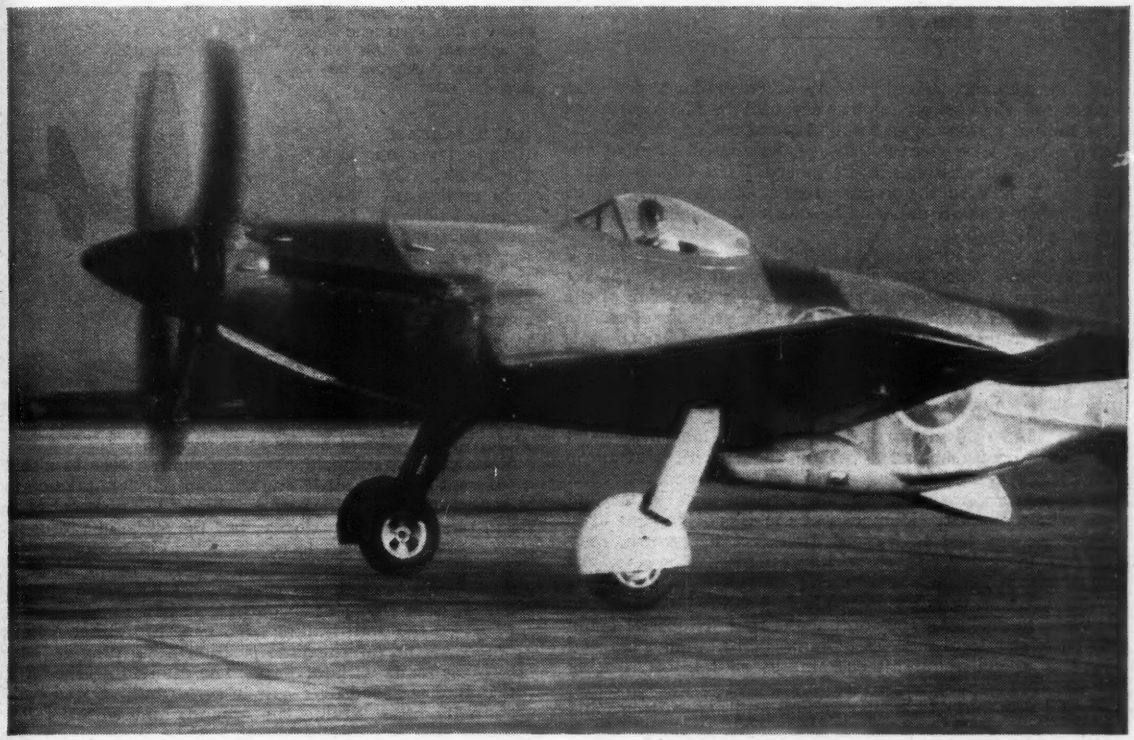


NENE-PANTHER: Powered by a Rolls-Royce Nene turbo-jet, of the type to be built under licence by Pratt and Whitney, the Grumman Panther deck-landing fighter for the U.S. Navy is seen on an early test flight. Like our own Hawker N. 146, a directly comparable type, the Panther should attain at least 600 m.p.h.



"Flight" photograph.

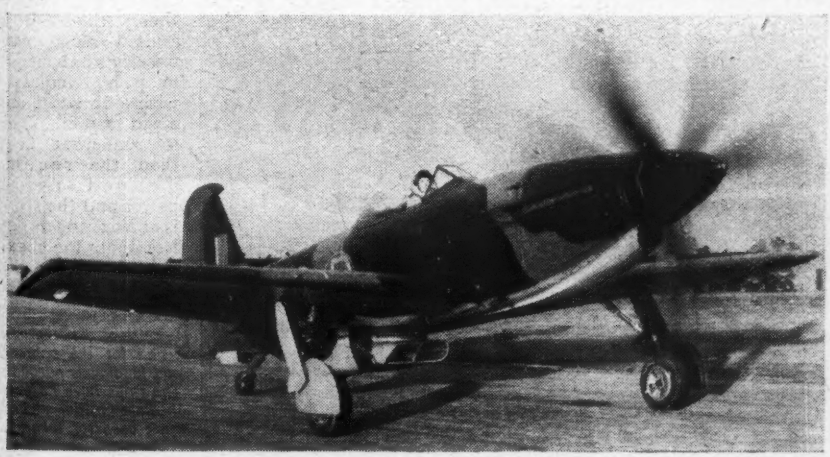
Thanks to the contraprop a straightforward first take-off was, in fact, straight. A prolonged take-off drill had resulted in a rather hot engine, hence the radiator flap in the manual open position.

M-B V in the Air

Reflections Upon Flying the Martin-Baker Fighter : Rolls-Royce Griffon Engine with "Contraprop"

By Wing Commander M. A. SMITH, D.F.C.

THERE is no doubt that when the Martin-Baker V made its first flight in May, 1944, it was in many ways ahead of its time. A great deal might have been learned from such an aircraft had it been put into production and service, and if a decision had been taken without undue delay, the M-B V (five) could have reached the squadrons in time to do useful work against the enemy. According to the Experimental Establishment at Boscombe Down the aircraft was perhaps the best all-round fighter ever tested by them. However, jet fighters are now the order of the day, and the M-B V is of historical interest only. Nevertheless, there is not a lot to choose between the performance of this three-and-a-half-year-old aircraft and the piston-engined fighters which are still in service, while of the general design and layout the official pronouncement in March, 1946, was that "this aircraft is excellent and is greatly superior, from the engineering



The exceptionally wide track makes the M-B V pleasantly stable for handling on the ground. When taxying into a bright, low sun as in this photograph, the flickering caused by the six airscrew blades is most disconcerting.

"Flight" photograph.

M-B V in the Air . . . . .

and maintenance aspect, to any other similar type. The layout of the cockpit might very well be made standard for normal piston-engined fighters, and the engine installation might, with great advantage, be applied to other aircraft." That was high praise indeed. The demonstration of the M-B V in the hands of S/L. Zurakowski will be remembered as an outstanding event at the Farnborough display in 1946.

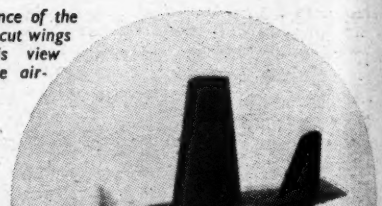
At Chalgrove airfield last week I looked over the M-B V for the first time, and in the absence of pilot's notes I was shown the knobs and switches by Mr. McLaren of the Martin-Baker Company. In spite of the presence of certain extra instruments in this prototype, the essential controls and dials were very easy to find and memorize.

A Man-Sized Fighter

Not having flown any similar type for a long while, and preparing to fly behind a Griffon engine with contraprop for the first time, I was impressed by the size and somewhat brutal appearance of the power section, and, in fact, of the whole aircraft. Memories of the friendly, squat little Vampire, the last high-speed aircraft I had flown, only tended to accentuate these impressions. However, the clean-cut businesslike appearance of the M-B V and its "office" were confidence-producing, and I climbed in "rarin' to go." In the short flight that followed I could do little but form a series of impressions. The plan had been to spend about fifteen minutes on take-off, getting settled and gaining some idea of the feel of the machine; another ten fairly high up, stalling and aerobatting; and finally ten minutes or so on the circuit landing. As it turned out it was necessary to climb straight up above Oxford to the only clear patch of sky before it, too, closed in.

The Griffon fired on the first "Coff" of the cartridge starter, and the Rolls-Royce rep. ran up and checked the engine for me. The de Havilland rep. had previously checked and topped-up the airscrew. Such attention was both comforting and flattering. It is necessary to anchor the M-B V for run up, and a tough-looking steel cable is employed, which runs from one of the main wheels through a pulley attached to a lug in the ground beneath the tail, then up to the rear end of the fuselage.

The very wide undercarriage with forward-raked legs gives a stable-feeling on the ground, and the long, well-shaped nose neither seems over-heavy nor obstructs the view for taxying. The Dunlop pneumatic brakes are operated, as is usual, from a lever on the stick. The only unpleasant feature I noticed on the ground was the most distracting stroboscopic effect of contraprops when taxying into the sun. One's eyes seem to be pelted with sun flashes. The effect is not so apparent in the air when the blades are turning faster. Incidentally, the visible cross-over point was with the pairs of blades at 12 o'clock.



The clipped appearance of the M-B V's thin, square-cut wings is apparent in this view taken over Chalgrove airfield last week.

Even when taxying, the tremendous response to a small movement of the throttle was apparent, and on take-off the M-B V was delightful. I used only +12 lb of boost (2,750 r.p.m.) and opened-up slowly, but the surge of torque-free power was magnificent to experience. On 100 octane fuel the Griffon 83 now has a "peace-time" rating at 18 lb, but originally +25 lb was permitted, an increase of about 500 h.p. over the +12 lb output. Phew!

Flaps of the split-trailing-edge type are either selected up or down, no intermediate position being provided, so a take-off is made without flap. The minimum take-off for the M-B V is 420yd over 50ft in zero wind. Speed builds up rapidly after leaving the ground, and wheels retract quickly, the only indication that they have moved and locked being that given by the warning lights. The throttle lever, placed above the pitch control, has a long quadrant and moves smoothly and positively. The pitch lever is, by comparison, rather sensitive, and a big change in r.p.m. results from quite a small lever movement.

Engine speed is controlled over a range of roughly 1,800 r.p.m. to 3,000 r.p.m., and the blades cannot be feathered. There is no doubt that the airscrew has a great deal of bearing upon all the performance characteristics of the M-B V. Not only is the equalized torque on take-off an advantage, but the immediate and unusually powerful response to r.p.m. or power changes over a wide speed range is at once apparent. Near the stall, particularly in climbing attitude, the pilot can almost feel the blades digging into the air, as if the aircraft were literally "hanging on the prop." The engine is virtually vibration-free, and the noise level in the cockpit is low.

Once up at about 8,000ft (and it didn't take long to get there) the M-B V cruised along very sweetly at about 315 m.p.h. indicated with ¾ lb boost and 2,250 r.p.m. This is somewhat less than the recommended cruising power and the speed is at least 100 m.p.h. less than the maximum for this height.

There seemed to

In spite of the long nose, vision for the approach and landing is adequate. The flaps have no intermediate position and are not used for take-off.
"Flight" photograph.

me to be an air of laziness about the way the controls operated. All have spring tabs, and their balance is commendable, so the slight sponginess felt with the otherwise positive action was probably responsible for this impression. Both ailerons and elevators are light wihout being overlight, although the stick pressure required for a slow roll at about 325 m.p.h. was rather more than I had expected. Control right round the roll was, I thought, exceptional. A loop at about 360 m.p.h., with only a slight increase in power on the way up, went according to the book.

As there was a slight doubt about the accuracy of the A.S.I., I decided to check the stalling speed before attempting to land. With flaps down, engine idling and attitude very slightly nose-up, the controls became pretty sloppy at 110 m.p.h. indicated at 5,000ft, and the aircraft stalled very gently away to the left at just over the 100 m.p.h. As the speed decreased to the stall with flaps down, the machine became increasingly tail heavy, although not sufficiently so to call for the aid of the trimmer which I left almost untouched at neutral from take-off to landing. Incidentally, the wing loading is 44 lb/sq ft.

Temperatures

It might be mentioned at this juncture that both aircraft and pilot were maintaining comfortable temperatures and pressures. The Griffon radiator was under automatic control and had settled at about 88 deg C, and the cockpit, which is without a heater, was kept comfortably warm by the engine radiator and its plumbing.

The magnificent towers, domes and spires of Oxford were now almost lost in the gathering haze to the north, and a silver loop of the Isis remained partly visible below to give me my position. Turning the tail to the red sun I commenced a long, shallow dive towards Mount Farm airfield, knowing that this would give me a line on Chalgrove, now hidden in the murk.

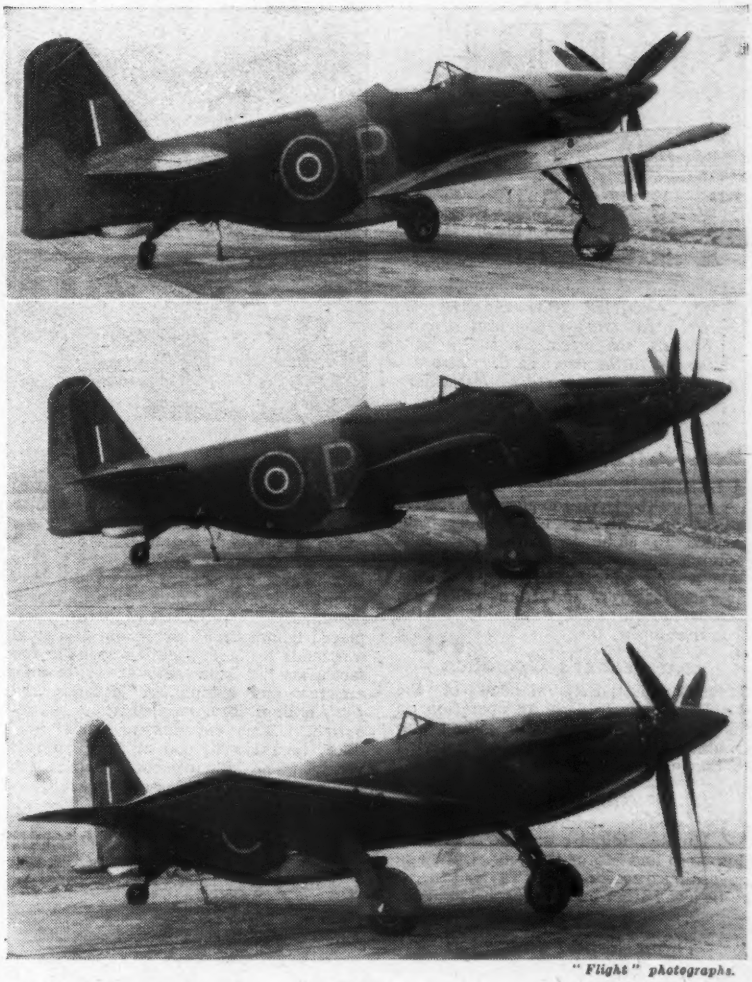
On reaching the home circuit at about the 1,200ft level, the A.S.I. showed 465 m.p.h. and the aircraft felt as smooth and solid as one could wish. Control was just as sweet when I went into a wide vertical turn around the field at this speed, and then flew down low and more slowly so that photographs might be taken.

Back on the circuit, when speed had fallen to 170 m.p.h., the wheels were lowered. Such was the retarding effect of throttling right back with the great airscrew in fine pitch that one might instead have been pulling on a hand brake. Flaps went down next as I commenced a wide turn-in at about 160 m.p.h. At about 300ft on the final approach the rate of descent seemed rather high, but a slight increase in engine power immediately checked this. When speed had fallen to 130 m.p.h. the aircraft was trying to assume landing attitude, but the view of the runway was still good. On crossing the boundry at about 115 m.p.h. I throttled right back and at the same time started the final round-out. A slight overdoing of the stick-back movement, plus a quick counter movement, and the effect of the spring tabs caused the ship to pitch momentarily, but she nevertheless both sat down and stayed down on three points in a satisfactory manner.

Taxying-in with more confidence than I had felt on setting out, I decided that the handling of the M-B V had been pleasing in every way, and that another hour or two on it would be a very enjoyable experience.

Fuel is carried in two tanks of 70 and 130 gallons capacity, the larger being behind the pilot and the smaller in front. Each tank has an electric pump, and a clearly marked electric gauge on the starboard consol.

If this aircraft were being prepared for service now, I should suggest certain minor alterations in the cockpit. The ignition switches under the left elbow did not seem well positioned, and the trim indicators are small and not too easy to read near the left hip. Although the controls *can* be reached when strapped-in, a harness release is also desirable. However, in all important aspects of equipment and control the M-B V definitely sets a very high standard.



"Flight" photographs.

Although it cannot claim beauty, the M-B V has a sleek, purposeful, rugged appearance. The engine is a Rolls-Royce Griffon 83 with maximum output of 2,340 b.h.p.

MARTIN-BAKER M-B V (F18/39)
Rolls-Royce Griffon 83

Span	35ft
Length	37ft 9in
Wing area	262 sq ft
Loaded weight	11,500 lb
Fuel capacity	200 gal
Normal range	1,100 miles
Max speed (at 20,000ft)	460 m.p.h.
Max speed (at 6,000ft)	425 m.p.h.
Climb to 20,000ft	6.5 min
Service ceiling	40,000ft
Stalling speed	97 m.p.h.

HERE AND THERE

YET ANOTHER JOB FOR THE SPIT. When an avia ion film was shown in Brussels, the organizers had a Spitfire brought to the Plac de Brouckère as an advertisement for the film. Mechanics are shown assembling the aircraft.

D.H. 106 Named

ALTHOUGH it will be some years before the D.H. 106 goes into service on the air routes, it has already been decided to name it the Comet, thus reviving the name of the de Havilland type which won the England-Australia air race in 1934, and from which the famous Mosquito may be said to have been developed.

Lord Tedder's Operation

LORD TEDDER, Marshal of the R.A.F., is to have an operation on his knee, which has been giving him trouble since he injured it during a visit to Somaliland.

Dr. Humby to Rest

ON medical advice, Dr. Graham Humby, founder and head of London Aero and Motor Services, Ltd., and governing director of Air Taxis, Ltd., is to be away from business for a long rest, probably for a year.

Tudor Report Presented

A CONFIDENTIAL report has been submitted to the Minister of Supply by the Tudor committee of enquiry. Lord Nathan told the House of Lords on December 10th that a decision about the presentation of the report to Parliament was to be taken. The committee began its deliberations on October 1st.

Mr. S. R. Worley

WE regret to record the death of Mr. S. R. Worley, F.C.A., chairman of Handley-Page, Ltd., in his 81st year. He became a director of the company in 1921 and was appointed chairman five years later.

Aircraft Engineers New Branch

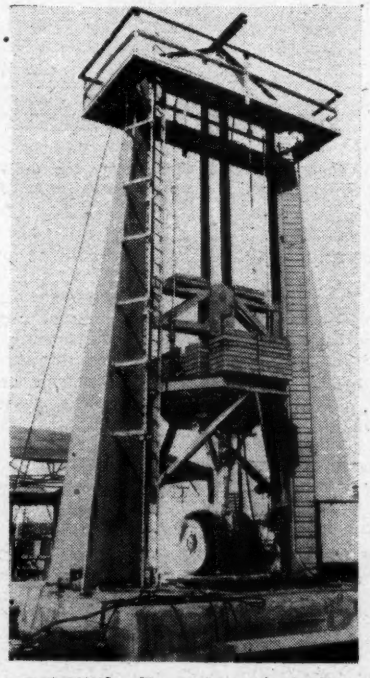
THE Society of Licensed Aircraft Engineers has formed a new branch at Langley airfield, Bucks. A full programme of lectures on technical subjects and discussion groups has been arranged. Later it is hoped to arrange visits to places of interest and to run film shows.

Sir Hugo Cunliffe-Owen

WE regret to record the death, after a heart attack, of Sir Hugo Cunliffe-Owen, Bt., chairman of Cunliffe-Owen Aircraft, Ltd., on December 14th. He was 77. He is succeeded by his son, Dudley Herbert Cunliffe-Owen, who is sales director of the firm. His eldest son, Hugo Leslie, who was in the Fleet Air Arm, was killed in 1942.

U.S. Industry Needs Big Orders

MAINTENANCE of the United States aircraft industry will require £187,500,000 worth of orders a year, according to Mr. Ralph Damon, president of American Airlines. He gave this figure in evidence before the President's Air Policy Commission in Washington, and his estimates were the lowest placed before the Commission. His total was made up of £75 million spent in ten factories, the same amount in engine, airscrew and component factories and £37½ million for administration and research. This expenditure would produce, he said, 3-4,000 military aircraft yearly. The industry could expect £25 million worth of business from civil airlines over the next five years, but private aircraft were of "no appreciable value" as a support to manufacturers.



BIG BUMP. The strain on the landing gear of a big aircraft is vividly shown by this test rig at Burbank, California. Loaded with lead weights, an undercarriage is dropped within a 40ft tower onto a concrete base. The wheels are spun to simulate actual landing conditions.

200 A.T.C. Cadets Parade

ABOUT 200 N.C.O.s and cadets of six Derbyshire A.T.C. squadrons attended the first parade of the County of Derby Wing at Alvaston, Derby, on December 6-7th. Films and talks were attended, aircraft and gun turrets in the Wing Airmanship Hall were inspected, and a Seafire was run up by instructors and cadets (using contaminated and condemned petrol). The Wing band held its first parade. W/C. W. T. F. Wightman, D.F.C., is O.C. the Wing.

Standards for Filters

IT was stated at the annual general meeting of the British Society of Associated Filter Manufacturers that the British Standards Association was expected to finalize its proposals for suitable standards of filtration and that these would be adopted by the filter makers. Mr. S. C. Toye, of Amal, Ltd., was elected president, on the retirement of Mr. Gordon Vokes.

Armstrong Whitworth Test Pilot

FOLLOWING his success with the experimental A.W.52 tailless jet-engined aircraft, S/L. E. G. Franklin, D.F.C., A.F.C., is to be chief test pilot with Armstrong Whitworth.

Flying Families and Fish

AN Airspeed Consul bought by Mr. O. H. Simpson for flying his own family and those of his friends to South Africa and flown by Mr. P. R. Matthews had, at July 31st, 1947, completed 11 flights between the U.K. and S. Africa, without the assistance of a crew, and completed 600 hours flying and 84,000 miles. The only mishaps experienced were a tailwheel tyre bursting on landing and a leak in the compass bowl. The 400-hour overhaul was carried out in England. On each trip a mileage of about 7,000 and flying time of an average of 50 hours was called for, which indicates a ground speed of about 140 m.p.h. In fact, the average true air speed was 145 m.p.h. and petrol consumption was 14.5 g.p.h. per engine, with 2 quarts of oil per trip, so that the fuel bill for each trip was about £217 10s. Mr. Matthews flew stages of about three hours, the journey between Southampton and Johannesburg normally taking less than ten days, with stops at Nice, Castel Benito, Cairo, Khartoum,

HERE AND THERE

Kisumu and N'dola, the stopping places in the southern stages being varied occasionally. Thirty-five adults and 11 children were carried, and the Consul is at present in South Africa, where it is employed on the transport of fish from Lorenco Marques.

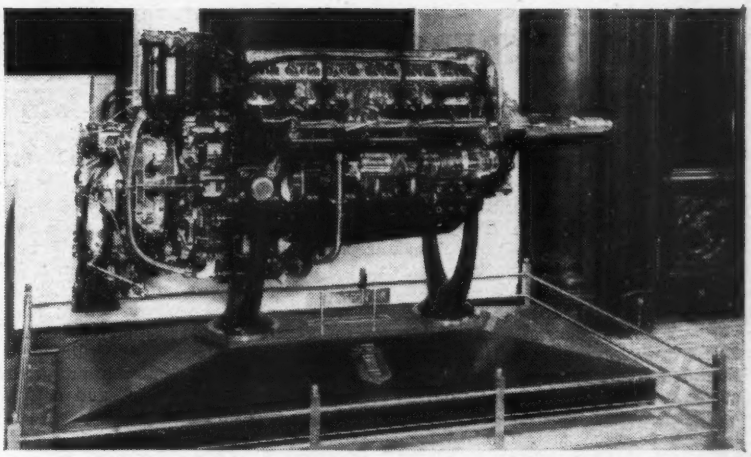
Down, and Up

WHEN an American aircraft landed in the sea a mile off Malta recently, the pilot was rescued by a helicopter which was taking out mail to the U.S.S. Aircraft Carrier *Midway*. The incident came at a time when there had been much interest in helicopters in Malta, since a local firm is considering the use of this type of machine for a service between Malta and Gozo Island.

Air Routes Exhibition

GEOGRAPHY of the air age and the development of air routes are to be the subject of an exhibition by the Royal Geographical Society at Kensington Gore, London, S.W.7. The Ministries of Civil Aviation and of Education and the airline corporations are co-operating, and Lord Nathan is performing the opening at 3.15 p.m. on December 22nd. The exhibition will remain open until January 15th between 11 a.m. and 5 p.m. every day except Christmas and Boxing Day. Large-scale models of airliners, flying boats, a helicopter and an airport will be on view, but the main section, "Planning an Air Route," is devoted to the administration and research necessary and also shows limitations imposed by weather, distribution of populations and geography (perhaps international politics should also have had a place!).

Exhibits will include a wall display and working demonstration of a Mk II GEE receiver, a miniature (35 lb) Mk III GEE set by Cossor; pictures of Consol long-range equipment; a model of the SR 45 flying boat with the Gouge docking scheme; a working model of the Fairey Gyrodyne; and a 9½ft model of the Hermes IV. Model airports are to be shown by Airwork, Ltd., and the Capital Press.



A GRIFFON IN GLASGOW: One of the exhibits at the new Engineering Centre. Although built at Derby, the engine was sectioned at the Rolls-Royce Hillington factory.

Engineering Centre Opened

WHEN the Engineering Centre opened at Glasgow on December 3rd is finally completed, it is to cover 100,000 sq ft. Designed as a permanent centre for the exhibition of engineering products and a source of technical information, the Centre is not intended to be a static affair in the manner of a museum, and exhibitors have been asked to bring their displays up to date continually. In addition, the technical officers of the Centre will be expected to be up to date in their information about any type of equipment and the best sources of supply; the whole bias of the Centre is to be towards technical information rather than sales. To make its activities better known abroad, all the foreign Consuls in Glasgow were invited to a reception on December 4th.

EVEN THE NOISE. This ground trainer at Lockheed's school, Burbank Cal., duplicates all the controls of a Constellation. Conditions of day and night flying are simulated, and the noise of the engines is reproduced.

News in Brief

Mr. Arthur Andrew Bage, chief designer of Percival Aircraft, has been elected an Associate Fellow of the Institute of the Aeronautical Sciences of the U.S.A. He was responsible for the Mew Gull, the Vega Gull, the Q.6 and Proctor, and is now busy with the Prentice, Merganser, and Prince.

* * *

Special kennels for 11 pedigree dogs were built into an aircraft which left Stanstead airport for Johannesburg recently.

* * *

Rates for gift food and clothing parcels to Europe have been cut by 33 per cent by Pan American Airways. The cuts will last until the Christmas traffic is over.

* * *

Mr. J. Billington, purchasing agent of the Metropolitan-Vickers Electrical Co., retires on December 31st and will be succeeded by Mr. G. T. King, the present contracts manager, whose place will be taken by Mr. H. Lawson-Jones.

* * *

Production of Rolls-Royce Nene jet-turbine engines in Australia for the R.A.A.F.'s Vampires has commenced. The first engines will be ready for testing in June.

* * *

Mr. J. P. Ryan is to be station superintendent of the B.O.A.C. station at Basra in Iraq; Mr. G. F. Watson is to take charge of the Almaza, Cairo, station; and Mr. B. L. Nelson has been appointed B.O.A.C. traffic superintendent, Middle East, with headquarters at Cairo. W/C. W. E. Knowldon is to be technical superintendent, Middle East.

* * *

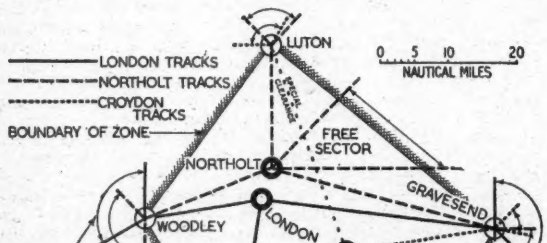
Another pilot who has passed the two million flying-mile mark has retired. He is Captain W. L. Garner, who joined the R.A.F. in 1919, served eight years as a ground engineer and transferred to Imperial Airways in 1926, becoming a pilot some time later. He took part in the wartime salvage of the flying-boat *Corsair*, forced down in the heart of the Congo. It took nine months of work, including damming the river, before the aircraft flew again. Up to his retirement he was flying B.O.A.C. Hythes.

Metropolitan Control Zone

Plans for Control of Air Traffic into London Airports : Shepherding Scheme to Avoid Collision Risk

THE intention of the Ministry of Civil Aviation to introduce a larger degree of Air Traffic Control in the U.K. as a whole, and to reorganize the Metropolitan Control Zone at the same time, has suffered a set-back, in that it has not been found possible to provide the services required to implement the full scheme.

Plans for the new pattern of the Metropolitan Control Zone, however, are going forward. They have had to be modified to fit the new situation, with the Control Zone surrounded by a Flight Information Region only, instead of by a Control Area as well. Amplification of this point is, perhaps, necessary. Control Zones extend from ground level to a fixed height (in this case 10,000ft A.S.L.), but Control Areas extend upwards from a height under which aircraft that are unable or unwilling to fly in the Control Area may move freely. Over most of the U.K. this lower limit was put at 3,000ft, much higher than anywhere else in Europe, where the heights vary from 700ft to 500 metres. This meant that if an aircraft wished to fly in controlled airspace all the time it must necessarily climb, while within the Control Zone, to at least the minimum height of the



The four marshalling beacon positions from which aircraft will be controlled within the London Zone. The track joining Luton and Croydon may only be flown with previous special clearance.

Control Area, and possibly even higher. If, therefore, aircraft are to be able to set course immediately after take-off the boundary of the Control Zone must be far enough away to enable the required height to be gained in straight flight. Yet it must not extend so far as to embrace additional airfields. It has been found that the best boundary line for the Metropolitan Control Zone is one joining Dunsfold-Woodley-Luton-Gravesend airfields and Tonbridge town.

The failure to establish a Control Area means that aircraft will have less climbing to do immediately after take-off, since they will be flying at quadrantal heights outside the Zone, and the lowest of those available will be 1,500ft, 2,000ft, 2,500ft or 3,000ft, according to the heading.

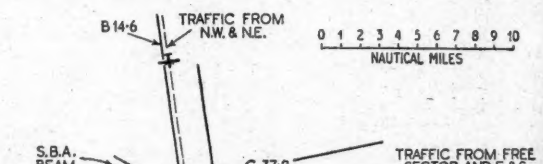
With the exception of the heights of entry and departure, the Ministry's scheme for the Metropolitan Control Zone, which has been under development for some time, remains unaltered, and the plans which British European Airways has made to correspond still stand. The Corporation being the largest user of the airport (Northolt) that handles the highest number of scheduled services in the London Area.

This M.C.A. plan, for use in Instrument Flight Rule conditions only, is based on three main assumptions; that aircraft will be flying at quadrantal heights outside the Zone, from 1,500ft upwards; that no tracks into and out of any airfield should conflict with those into and out of any other; and that the highest common navigational factor will be MF/DF.

Accordingly, four MF omni-directional Beacons will be sited approximately North, East, South and West of London, and a Zone boundary will be drawn joining these beacons, with an extension to Tonbridge in the S.E. corner. All traffic entering or leaving the Zone must do so by one of the beacons, and follow a pattern as shown in the diagram, to ensure that tracks do not cross; the only exceptions to this principle are in the two free sectors, one for Northolt and one for Croydon traffic, and the special case of northbound traffic from Croydon, which may cross other tracks by special clearance from London and Northolt.

Secondary Airfields in I.F.R. Conditions

It will be seen that all traffic is expressed in terms related to London Airport, Croydon and Northolt. That must not be interpreted to mean that other airfields will be closed in IFR conditions, but that they will be grouped under



Northolt Approach procedure in I.F.R. conditions using Gee. The lattice lines are shown.

the three main Approach Controls, so that Bovingdon traffic would be controlled by Northolt, Langley by London, and so on.

At the beacons themselves, heights will be allocated permanently to the Approach Controls using each beacon, so that each of the three principal Approach Controls can clear aircraft in and out without having to co-ordinate its movements with any of the others; if this system works, it should accelerate the flow of traffic into each airfield, while keeping aircraft safely height-separated at the beacons over which they are all funnelled. Safe height separation will not be achieved, of course, unless the heights allocated at the Beacons are all flown in relation to a common altimeter setting, whether it be a Zone QFF (what is the actual barometric pressure, reduced to sea level at . . . .), a QNH (what is the present altimeter setting at . . . .) or a Standard Pressure.

Under this scheme, incoming aircraft would, in theory, descend from their entry heights at the beacons to their airfields of destination, thus eliminating the waste of time in losing height over the airfield. In practice, however, aircraft would often require to be held, and it will

be more expeditious to do this over the airfield than at a beacon which was being used by other aircraft.

The assumption that navigation by MF Beacons is the Highest Common Factor that can be depended upon is no doubt justified, but the M.C.A. plan, while designed to control aircraft fitted with MF only, allows aircraft to enter the Zone along B 14.6, and follow that lattice until they do so at, or near, the appropriate Beacon. For example, an aircraft from the West may enter the Zone by means of the Reading intersection, but would count for purposes of separation and clearance as Woodley traffic.

This feature of the plan will enable Gee-fitted aircraft to enter the Zone and make a Let-Down by a simple procedure involving Gee and SBA. Gee lattice lines can be selected which would enable aircraft to be navigated from each of the three points of entry applicable to Northolt, and the Free Sector, to a "Gate" on the SBA Beam at 10 n.m. from the Main Beacon.

The aircraft would approach the Boundary of the Control Zone along the prescribed lattice line, and, when permission had been given to change to the Approach frequency and to enter the Control Zone, would continue along the Lattice Line to the Gate. Normally, communication with Approach Control will be on VHF R/T by the First Officer, leaving the Radio Officer free to operate Gee.

This procedure, as it would operate at Northolt with Runway 13 in use, is shown in the diagram. Traffic from the N.W.-N.E. Sector (e.g., the Glasgow service) would enter the Zone along B 14.6, and follow that lattice until C 37.8 was reached. A Rate-one Turn to Port of 40° would bring the aircraft into the Beam at 10 n.m. from the Main Beacon. Traffic from N.E.-S. (e.g., Amsterdam or Geneva) would have a more complicated route. Entering on C 37.0 the aircraft would fly westwards over Ruislip Reservoir, whence a contact landing would be made if possible; if not, the aircraft would continue out to B 14.5, where a starboard turn through 215° would bring it into the Beam. The approach from the S.-N.W. Sector (e.g., Jersey) would be simple, following C 37.5 to B 14.6 and then turning starboard into the Beam.

The pattern for Runway 26 (if the Beam were operational) would be similar; both have been flight-checked and found practicable, provided the aircraft arrives at the Gate with wheels down, speed reduced, and at a height not greater than 2,000ft QFE.

When VFR conditions apply, or when for any reason a Beam approach is not possible or not necessary, a "Circuit Homing" procedure is provided by means of Gee to bring the aircraft, not to the centre of the airfield, but into the circuit.

An extension of the Gee/Beam procedure to other airports is not immediately contemplated, and will depend on many circumstances, including, of course, the degree of success achieved in the Metropolitan Zone.

HELICOPTER PROBLEMS

TREATING the rotor of a helicopter as a disc, without taking into account the number of blades, Mr. H. B. Squire, of the Royal Aircraft Establishment, took the theories developed by Glauert and Lock a step farther in his Paper read before the Helicopter Association of Great Britain on December 6th.

The Paper was very far from being of a popular nature, and several members of the audience frankly admitted that they did not understand it. The lecturer dealt with calculations of the induced velocity field and with rotor interference in multi-rotor helicopters. The spacing was important both in tandem and in side-by-side rotor arrangements. Close spacing reduced induced drag in side-by-side rotors, but increased it in a tandem arrangement.

CENTRAL PHOTOGRAPHIC ESTABLISHMENT

IN connection with a photographic reconnaissance conference, held at the R.A.F. Central Photographic Establishment from December 10th to 19th, an exhibition of the latest cameras and air survey technique was on show in one of the hangars at Benson airfield, the home of C.P.E. Of particular interest was the application of radar to air survey, and the employment of moving film cameras in place of the orthodox type for high-speed low-level photography.

A review of the highlights of the exhibition will appear in the next issue of *Flight*.

"*Flight*" photograph

APPRECIATION: Capt. Lamplugh making the presentation of a silver salver to Leslie Irvin at Londonderry House. The ceremony reported in last week's issue.

TAX CONCESSION FOR R.A.F. RESERVES AND AUXILIARIES

MEMBERS of the R.A.F. auxiliary and reserve forces are to have an exemption from income-tax for training expense allowance and bounty payments, and this exemption will be retrospective from April 6th, 1947. Ordinary pay and taxable allowance paid for periods of continuous training exceeding 48 hours' duration are not included.

The training expenses allowance included in the exemptions is that which is paid at an hourly rate for training periods of less than 48 hours. The bounties included are the flying-training bounty (formerly "retaining fees") payable to flying members of the R.A.F.V.R., the Auxiliary Air Force, the Reserve of Air Force Officers, and the W.A.A.F./V.R. list (flying); annual bounties payable to ground airmen of the R.A.F.V.R. and A.A.F. and to airwomen of the W.A.A.F. reserve list; and the flying-training bounty of £10 a year for airmen of Class E of the R.A.F. Reserve.

ATOMIC PHYSICS FILM

BEFORE an international audience, an authoritative film on the development of atomic energy was given its first showing in London recently. Seriously conceived and carefully produced, it was prepared with the co-operation of eminent scientists, learned societies and research institutions.

The subject is dealt with historically, and the long series of discoveries is presented in chronological order. Either the actual experimental equipment used or scientifically accurate replicas are shown in the film, and carefully preserved sequences of such eminent men as Sir J. Thomson and Lord Rutherford speaking on atomic theory are introduced.

The film falls naturally into five parts: Atomic theory; rays from atoms; nuclear structure; atom smashing and uranium fission—which can be shown individually or as a continuous whole. Animated diagrams are an outstanding feature, and the photography of such difficult subjects as electron tracks in cloud chambers is excellent.

Short sequences of the first atomic bomb in Mexico, the Hiroshima bombardment and the Bikini test vividly show the destructive potentialities. Living authorities, Prof. Einstein, Dr. Cockcroft, and Prof. Frisch, discuss the present stage of development, and the prospect of peaceful utilization.

Close-ups of Hitler haranguing, and shots of Nazi military parades, strike a somewhat incongruous note in this record of continuous scientific endeavour dating from the year 1808, when John Dalton propounded the atomic theory. They were probably taken before uranium fission was discovered in 1939. The elision of the nationality and domicile of the woman scientist Lise Meitner and Prof. Frisch, who first noticed this phenomenon, is not expected in a strictly factual film of this character. These, however, are minor criticisms. G-B Instructional, Ltd., a branch of the J. Arthur Rank Organization, is to be congratulated on the production of a fine film of absorbing interest and undeniable educational value.

CRANFIELD ON SHOW

Minister of Education Visits the College of Aeronautics : Board of Governors Present

Illustrated by Flight Photographs

Expense has been saved by fairly extensive use of German equipment. The Minister and Mr. Relf are seen examining a German automatic pilot while Mr. Colbran, chief instructor, explains.

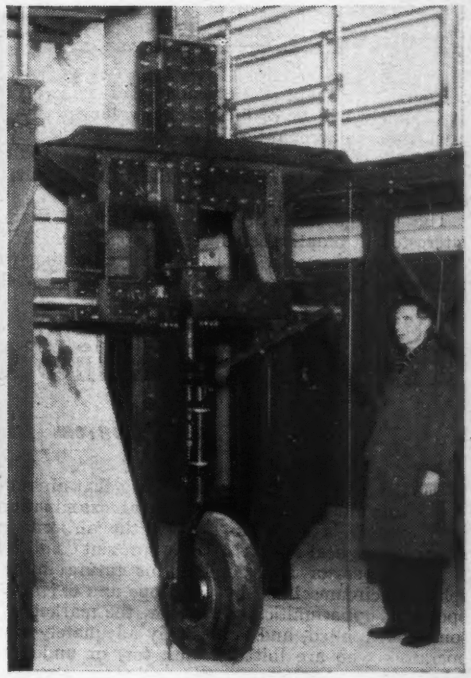
ON the occasion of an inspection by Mr. George Tomlinson, Minister of Education, on December 8th, the state-owned College of Aeronautics at Cranfield was open to visitors for the first time. As early as May, 1943, *Flight* took an active interest in the founding of a university of aeronautics and our Managing Editor in a letter to the *Daily Telegraph* discussed requirements and made proposals in some detail at that time. The requirement was also supported by Sir Roy Fedden and Mr. F. G. Miles. The stages in development following the campaign by *Flight* and the *Daily Telegraph* will be now known to most people ; the first official reaction was the announcement in the House of Lords by Lord Cherwell that the Aeronautical Research Council had been directed to look into the possibility of founding a school of aeronautical science. Following this report, presented in August, 1943, Sir Stafford Cripps, then Minister of Aircraft Production, announced approval of the recommendations and the setting up of a committee with Sir Roy Fedden as chairman, to prepare detail proposals for the establishment of such a school. In view of the unfavourable conditions which have continued to exist since that time, the original somewhat grandiose scheme had necessarily to be modified, but this did not reduce the impetus of the scheme, and in October of last year the College opened at Cranfield airfield near Bedford, with an intake of some 45 post-graduate students.

Since that time the College has developed in a most creditable manner, and in spite of economic problems and the difficulty of obtaining labour and materials, a great deal of equipment has been installed and much more delivered awaiting installation. Expense has been saved by the use of some tools, testing equipment and wind tunnels of German origin.

Some details of conditions of entry, syllabus, and departments within the College were given, prior to the opening, in *Flight* of July 25th, 1946. To summarize the main details, the course covers a period of two years, each being divided into three terms. A new entry is taken in each year, and the second session (1947/1949) with an intake of 47, commenced on October 6th last. For the first year the course is the same for all students, but deficiencies in the knowledge of individuals, i.e., weakness in mathematics or no knowledge or experience of aircraft, machine tools, factory practice, etc., can be made up. During the second year, instruction is divided between three main courses covering aerodynamics, structures and power plants. The present position is that the 37 "surviving" students of the first intake have commenced their second year and 47 of the second intake are just completing their first term. The majority are from the aircraft industry and Services.

At the luncheon given for the Minister of Education and

This luncheon group includes (left to right) Prof. Lickley, Sir William Stanier, Mr. Relf, Air Chief Marshal Ludlow-Hewitt, Prof. Duncan, Dr. Abbott, Mr. Muir and Sir Roy Fedden. In the foreground are Air Marshal Sir Ralph Sorley and G/C. Hockey (right)



(Above) Principal of the College, Mr. Ernest F. Relf, is asking Mr. Tomlinson to examine the rocket motor in the tail of the captured Me163.

(Right) The recently installed drop test rig. Professor Lickley, chief of the aircraft design department, stands beside the equipment.

guests, which was attended also by the Board of Governors and the staff and students of the College, the Chairman of the Board, Air Chief Marshal Sir Edgar Ludlow-Hewitt, G.C.B., G.B.E., C.M.G., D.S.O., M.C., said that this was a time when scientists and technicians had come into their own, and that the superior performance of aircraft had had a great effect. Fighter pilots in the Battle of Britain had held their own against the enemy, even when flying aircraft of inferior performance. When they were given better aircraft they swept the sky. Bomber pilots, too, were happier when they knew that they could hit their targets. This showed the advantage of having technicians.

The Air Marshal added that the Royal Air Force felt the need for highly skilled operators as devices increased and improved. Such things permitted safer but not simpler operation. The country was now dependent on technical development for solutions and its own development, and so required the help of highly skilled types. It had been shown recently that not enough were available, hence this College. While it was possible to provide training, talent could not be provided, and this must continue to be attracted. The College would be judged by results, and it would take 10, 12 or even 15 years to show whether the right men had been drawn or not. The Chairman went on to say that the speed of development of the College had not been commensurate with requirements, and that building had been held up, and there were some obvious deficiencies at the present time. For this reason there had so far been no formal opening. At present the number of students in college is low due to the lack of accommodation, but he was very grateful to the R.A.F. and Air Ministry for the use of one of its best permanent R.A.F. stations.

Mr. George Tomlinson made the point that although State-provided the College was independent, and he hoped, therefore, "to get back the best of both worlds." He looked forward to technical advances in consequence of which flying would become safer and would be of use to all, not just a branch of the community.

Air Experience

When it first opened, the College shared Cranfield with the Empire Test Pilots School, but this has now moved to Farnborough because the accommodation was inadequate for both. It was agreed by many people that the association of the two units was of great value and the need for separation rather unfortunate. However, there is within the College organization a flight section equipped with Ansons, Halifaxes and Tiger Moths. Students will, therefore, get air experience while taking practical observations in the air and, in addition, flying instruction as pilots up to A-licence standard. For a nominal fee of 10s an hour students will also be able to continue their instruction and put in some solo flying. That it is advantageous for technicians to have some experience of the practical side of flying is recognized.

The relatively large proportion of German equipment used for instructional purposes was the subject of some comment and criticism, but it was suggested that the undeniable skill of the German technicians as demonstrated by this equipment, which had nevertheless proved to be insufficient to win the war, gave an indication to students of the standard at which they themselves must aim.

With regard to the accommodation and amenities of the College, there is no doubt that students of most of the universities could hardly fail to envy their contemporaries at the College of Aeronautics, were they to see the comfortable and spacious lecture rooms, laboratories and quarters into which the fine R.A.F. buildings have been skilfully converted.

BOARD OF GOVERNORS

CHAIRMAN Air Chief Marshal Sir Edgar Ludlow-Hewitt, G.C.B., C.B.E., C.M.G., D.S.O., M.C.; **Members** Dr .W. Abbott, O.B.E., H.M.I. (Min. of Education); J. Fearn (S.B.A.C.); Air Marshal Sir W. Alec Coryton, K.B.E., C.B., M.V.O., D.F.C. (M. of S.); Sir Charles Darwin, K.B.E., M.C., D.Sc., F.R.S. (Dept. of Scientific and Industrial Research); Sir Roy Fedden, M.B.E., D.Sc., F.R.Ae.S. (R.Ae.S.); J. Ferguson, M.A., B.Sc., H.M.I. (Scottish Education Dept.); Sir Harold Hartley, K.C.V.O., C.B.E., M.C., F.R.S. (Independent); Prof. Sir Melvill Jones, C.B.E., A.F.C., M.A., F.R.S., F.R.Ae.S. (The Universities); Prof. E. B. Moullin, M.A. D.Sc. (Institution of Electrical Engineers); J. D. North, F.R.Ae.S. (S.B.A.C.); Sir Frederick Handley Page, C.B.E., F.R.Ae.S. (Independent); W. C. G. Cribbett, C.M.G. (Ministry of Civil Aviation); Rt. Hon. The Earl of Selkirk, O.B.E., A.F.C. (Secretary of State for Scotland); Air Marshal Sir Ralph Sorley, K.C.B., O.B.E., D.S.C., D.F.C. (Air Ministry); Dr. H. Roxbee-Cox, D.I.C., B.Sc., F.R.Ae.S.(R.Ae.S.); Sir William Stanier, F.R.S. (Institution of Mechanical Engineers); Vice Admiral Sir Philip Vian, K.C.B., K.B.E., D.S.O. (Admiralty); W. E. F. Ward, C.M.G., M.A. (Colonial Office); A. Cde. U. E. Ewart (Government of Australia). Vacant seats: the Government of India and The Universities.

THE STAFF

PRINCIPAL: Ernest F. Relf, C.B.E., A.R.C.S., F.R.Ae.S., F.R.S.; Professor of Aerodynamics: W. J. Duncan, D.Sc., A.M.I.Mech.E., F.R.Ae.S.; Professor of Aircraft Design: Robert L. Lickley, B.Sc., D.I.C., F.R.Ae.S.; Head of Dept. of Aircraft Propulsion: N. S. Muir, B.Sc., F.R.Ae.S.; Head of Dept. of Flight: G/C. R. C. Hockey, D.S.O., D.F.C.; Registrar: V. F. Knight.

Cranfield on Show . . . . .

There is no doubt that attendance of the two-year course at Cranfield will be of inestimable value to anyone taking up a career in aeronautics. The course is expressly designed to provide scientific and engineering training to fit students for leadership in the aircraft industry, civil aviation, and the Services.

The College authorities state the view that students interested in practical engineering would benefit by spending a year or two in industry after obtaining the school certificate and before going to the university or elsewhere. This would better fit them for industrial employment after the post-graduate course. This may involve an increase of two years in the total training period, but it is pointed out that the extended period is no longer than is found necessary in other professions. Additionally, it is suggested that engineering students should take every opportunity to acquire facility in the use of their hands.

Normal tuition fee for the two-year course is £75 per year. Cost of maintenance in the Hall of Residence, £100-£150 p.a. Fees for British or foreign students from abroad are so far unsettled, but will be rather higher than the figure mentioned above. It is hoped that scholarships may become available.

The Air Radio Operator and the Future

New Courses Initiated by Air Service Training

THE recent regulation providing that air radio operators must undergo an annual examination for air fitness is likely to shorten the airborne career of many for medical reasons. Under present conditions, when a radio operator is grounded, his future in his chosen sphere is circumscribed by the scope and extent of ground operating opportunities. However, the market is basically somewhat limited, and is normally adequately supplied by operators who are initially unfit for, or undesirous of, a flying career, or by air radio operators who have, as it were, become "time expired." It is frequently found, of course, that ground openings are virtually non-existent even for this latter class.

What, then, is the solution? It is part of the duty owed to the individual and to the industry by reputable training establishments to provide the solution of this type of problem in all branches of aeronautics, and Air Service Training has been considering this particular problem from all angles and approaches. It was decided that the obvious solution is initially to provide the air radio operator with additional qualifications which will increase his "market value," and extend the potential market for his services on the ground. There are other advantages, both for the individual and for the airline or air charter operator, accruing from the recently instituted Wireless Operator/Mechanics' Course, which is the answer of Air Service Training to this problem.

Apart from assisting the individual in his transition from air to ground employment, and the extension of his potentialities beyond those of pure air operating, the radio operator who is trained also as a wireless mechanic becomes a far more efficient operator, by reason of his increased technical knowledge of the "box of tricks" which he handles in the air. If his subsequent ambition should extend beyond that of a ground wireless mechanic or operator, his previous practical experience when operating as an airline operator/mechanic will qualify him for a Radio Engineer's Licence after a comparatively short radio-theory course. Thus, by extending his basic qualifications, the air radio operator enhances his value to the industry and increases his own prospects of long and progressively remunerative employment in that industry, or in kindred industries.

Air lines and charter companies, both in this country and abroad, experience an increasing need for air radio operators who are capable of servicing and maintaining their own aircraft equipment. Many airfields and smaller airports abroad are inadequately staffed with wireless maintenance personnel, and frequently an aircraft is grounded and held up solely because of a wireless fault. Others have to force-land at some remote airfield because of such a fault (which might, with knowledge, be rectified in the air), and local resources are totally inadequate to effect a repair.

The air radio operator is not normally trained or qualified to handle such situations, and if a local mechanic of the necessary skill and experience is not available, considerable delay and consequent expense are entailed. It may then become necessary to dispatch a relief aircraft to the spot to pick up passengers or freight, and to take out a skilled mechanic capable of diagnosing and correcting the fault. Failing this is becomes necessary to call in outside assistance, often from a distance, and this practice is apt to prove expensive. If, however, the air radio operator is also a trained mechanic, familiar with the internal intricacies of his equipment, and fully capable of tracing and rectifying the fault, he can carry out a repair on the spot with minimum delay, dislocation, and expense.

The qualified wireless operator/mechanic, with his increased operative skill, increases the safety factor for crew and passengers (or freight) alike; and increase in overall crew efficiency and greater service potential must inevitably lead to a greater general running efficiency, coupled with greater regularity of the air service.

Nor does the usefulness and adaptability of the radio operator/mechanic cease to be of value on return to base. He can be employed, while his aircraft is grounded, on wireless maintenance, under the direction and control of the chief wireless mechanic and the licensed radio engineer. His experience in using the equipment is an asset in his maintenance of it, just as his experience in maintenance is an asset in operation. The ultimate development of this arrangement is a reduction in the number of purely ground wireless mechanics required for a given number of in-use aircraft, thus involving less "idle time" while the aircraft is airborne, while the "idle time" of the air radio operators is correspondingly reduced when the aircraft are grounded. In any case, the efficient servicing of aircraft equipment by the operator will reduce the requirement for ground servicing and repairs on return to base.

In order to ensure the requisite degree of skill and knowledge, when the training is completed, a course for air radio operators on conversion to wireless mechanics, must be of six months' duration, with approximately 75 per cent of that time devoted to practical work. The last eight weeks can usually be employed in the operation, servicing, and fault-tracing on "Gee" and similar equipment, while the early stages of the course are concerned with repair and testing techniques, construction and fault-tracing of receivers and transmitters, and general servicing and fault-tracing on standard aircraft equipment, including the intercommunication amplifier.

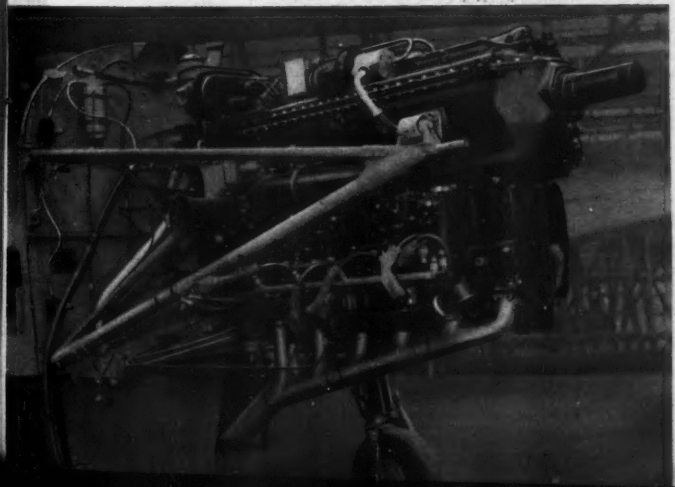
After such training as given by the Radio and Radar School of Air Service Training at Hamble, an air radio operator is fully able to maintain, service, and repair his own equipment or that of any other aircraft. He has become a radio operator/mechanic, competent in the fullest sense of the term, and familiar with all phases of the work entailed. His qualifications have been enlarged, his competence and efficiency increased, while his value to the airline or charter operator has been enhanced. What is more to the point for the air radio operator himself, he has a more assured future within the industry.

The New Basic Trainer

Structural Analysis of the Percival Prentice : Simplicity, Inherent Strength and Ease of Production are Keynotes of Design

WHEN Specification T 23/43 was being evolved itemizing the requirements for an entirely new type of basic trainer, it is unlikely that very much thought was given to the extremely difficult design job entailed in producing an aircraft to meet those requirements. It is no part of our intention here to dilate on the flying or operational characteristics of the machine; that will come later. In this review we shall concern ourselves with a factual description of the physical make-up. We can, however, state that Percivals have tackled their problem with a good deal of imagination, and the results of their labours would seem to have resulted in an aircraft capable of performing its complex duties in able fashion.

The Gypsy Queen series 32 engine is mounted low-down in order to cause the least infringement of view and, as may be seen at right, the simple car-bonnet-type engine cowling affords the maximum freedom of access to the engine to permit ease of maintenance.



Before devoting our attention to the detailed elements of the Prentice it would, perhaps, be well to consider first the extraordinary wing tips. For some curious reason, these are known as "polyhedral" tips; we say curious because to us polyhedral means many-sided and, therefore, in this context its use is not justified. It would seem to be just one more occasion of the use of inept officialese —incidentally, Percivals disclaim all responsibility for the term, it was wished on them from "authoritative quarters." If a euphuistic word for these simple cocked tips was necessary, plagiedral or acclivous would, we suggest, have served the purpose whilst having the additional advantage of being accurate.

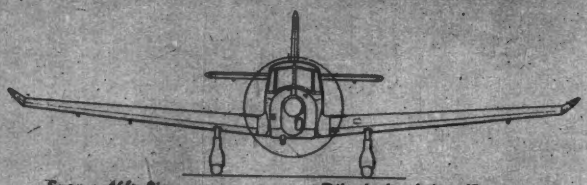
Flight trials of the prototype made it clear that the existing dihedral was insufficient, with the result that the stability in inverted flight was too great. Since to increase the dihedral would have meant considerable modification to the wing jigs as well as entailing a lengthened undercarriage and a modified strut anchorage, it was decided instead to obtain the effect of increased dihedral by cocking the wing tips up at an angle of 30 deg. Thus it is that an effective dihedral of 6 deg is obtained with an actual wing dihedral of 4 deg 45 min. This simple modification has not only achieved its primary purpose but has also markedly improved the aircraft's rate of roll and, too, has improved the sideslip controllability. The only thing not improved is appearance, but that quality in a Service trainer is, perhaps, of little moment.

Structually; one of the most noteworthy aspects of the Prentice is its obvious facility of production; and, of course, for an aircraft which is to be built in the quantities envisaged, this feature is of prime importance. Allied to design for production and, perhaps, because of it, is absolute simplicity of construction. The Prentice is, *par excellence*, an example of modern all-metal orthodox construction reduced to its most uncomplex form. As a design, the aircraft is also distinguished by a degree of maintenance accessibility which, in these days, is becoming increasingly rare. For duties such as those the Prentice is intended to perform, ease of maintenance can be assessed as a cardinal advantage.

Starting from the nose and working aft, the airscrew is

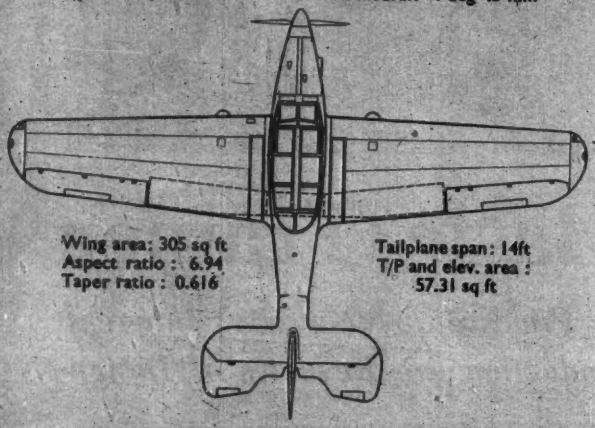
The New Basic Trainer

One DH Gypsy Queen series 32 engine giving 250 b.h.p. for take-off at Sea Level, and driving a DH bracket-type, all-metal, two-blade, c.s. airscrew of 7ft 6in diameter.



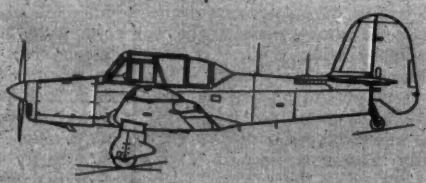
Span : 46ft 0in

Dihedral: 4 deg 45 min



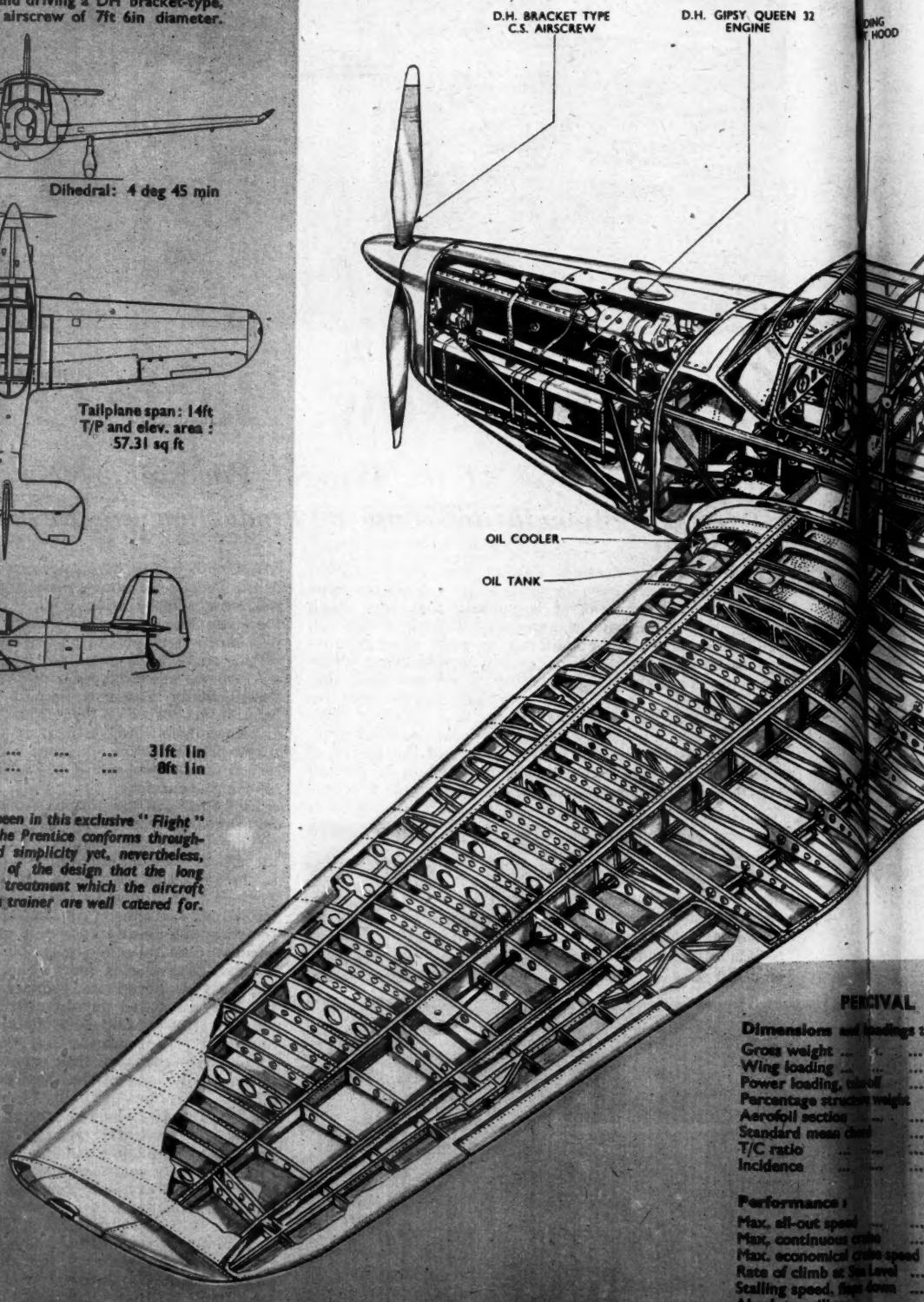
Wing area: 305 sq ft
Aspect ratio : 6.94
Taper ratio : 0.616

Tailplane span: 14ft
T/P and elev. area : 57.31 sq ft



Length	31ft 1in
Height, tail down	8ft 1in

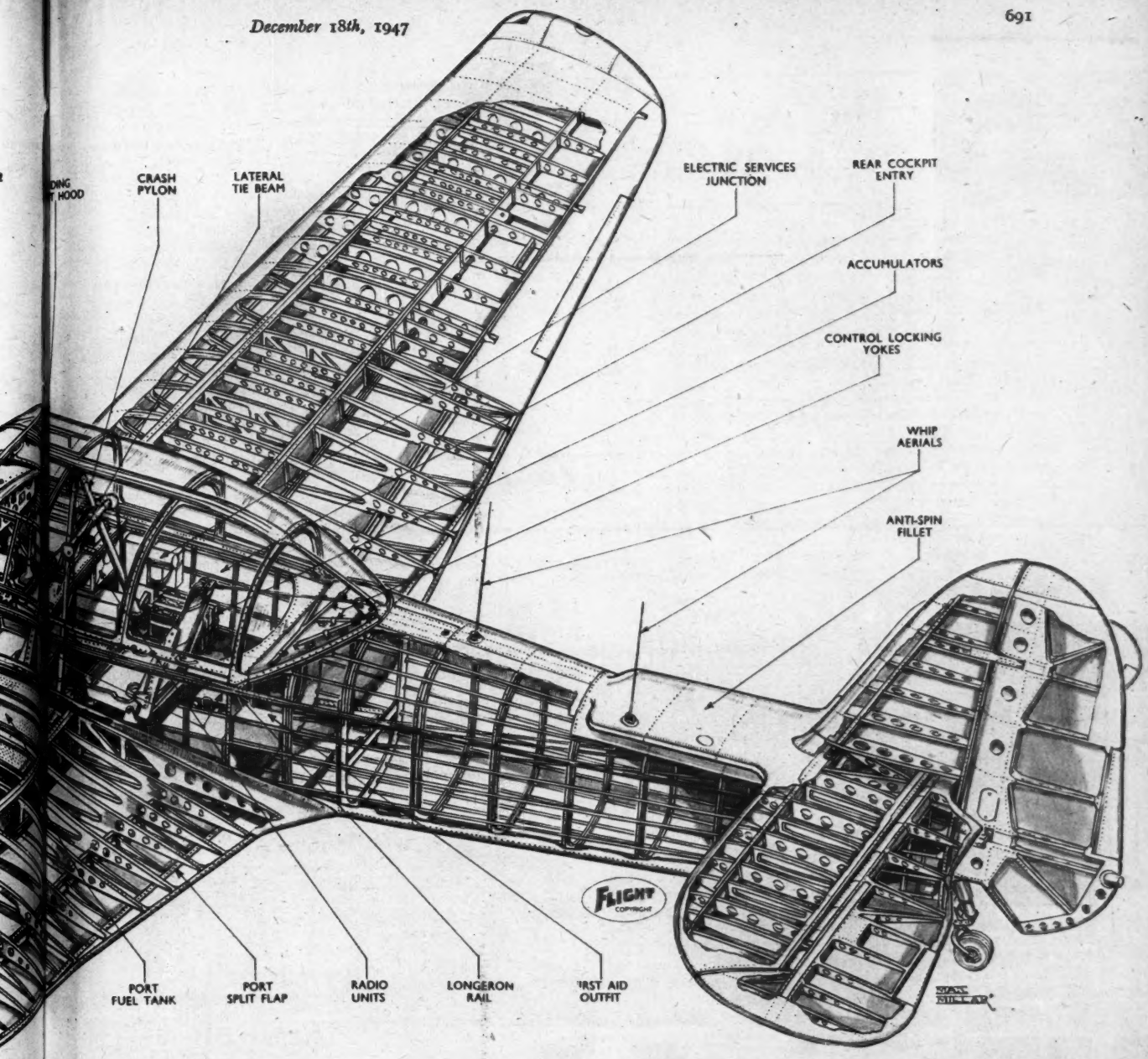
STRUCTURALLY, as may be seen in this exclusive "Flight" drawing by Max Millar, the Prentice conforms throughout to a standard of marked simplicity yet, nevertheless, such is the inherent strength of the design that the long hours of work and the rough treatment which the aircraft is likely to meet as a Service trainer are well catered for.



PERCIVAL

Dimensions and loadings :
Gross weight ... ...
Wing loading ... ...
Power loading, take-off ...
Percentage structure weight ...
Aerofoil section ... ...
Standard mean chord ...
T/C ratio ... ...
Incidence ... ...

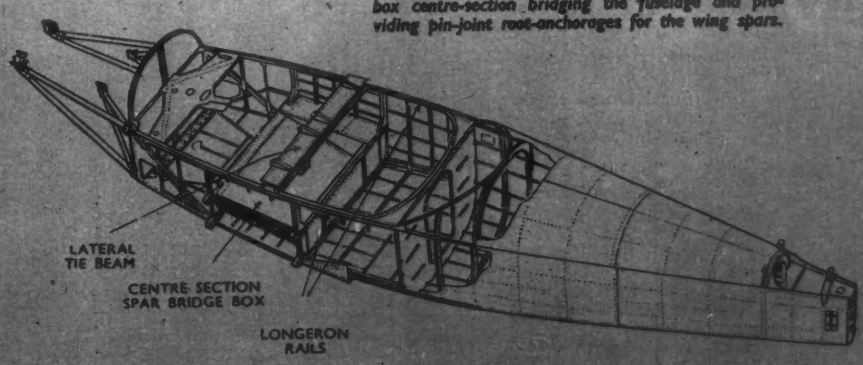
Performance :
Max. all-out speed ...
Max. continuous cruise ...
Max. economical cruise speed ...
Rate of climb at Sea Level ...
Stalling speed, flaps down ...
Absolute ceiling ... ...
Service ceiling ...



PERCIVAL PRENTICE — DATA

...	3,850 lb
...	12.6 lb/sq ft
...	15.4 lb/b.h.p.
...	48.5
...	R.A.F. 48 modified
...	6ft 7.6in
...	0.18 root, 0.09 tip
...	2 deg
...	150 m.p.h. at Sea Level
...	145 m.p.h. at 2,200ft
...	140 m.p.h. at 3,500ft
...	700ft/min
...	55 m.p.h.
...	16,500ft
...	15,000ft

The fuselage is composed of panel sub-assemblies which go to make a semi-monocoque structure in the forward portion of which is incorporated a torsion-box centre-section bridging the fuselage and providing pin-joint root-anchorages for the wing spars.



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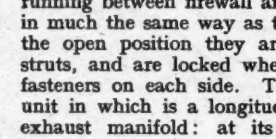
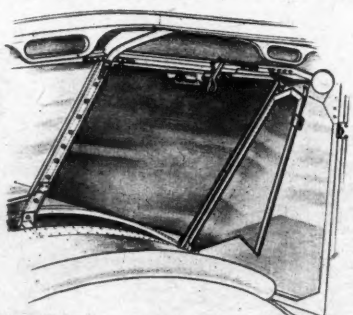
a de Havilland all-metal, two-blade, bracket-type c.s. unit of 7ft 6in diameter. This is driven by a D.H. Gypsy Queen 32 engine which provides 250 h.p. for take-off. For use in Rhodesia and such regions where airfields at considerable elevations are combined with semi-tropical climatic conditions, the Prentice is intended to employ a Gypsy Queen series 51 engine, which, being supercharged, gives a take-off and initial rate of climb performance at 5,000ft largely similar to that given by the 32 series engine at sea level. However, the successive "after-thought" requirements for the Prentice have already put up the gross weight by about 240 lb, and it may thus well be worth while to supplant the 32 series engine by the 51 series units as the standard power plant and, in turn, supplant the 51 series engine by the supercharged and geared 71 series for Rhodesian and similar conditions. This step-up in engine power is, nevertheless, unlikely to materialize for some while, if for no other reason than that the engines are not yet fully emerged from the development stages.

The power unit is carried in a pair of tubular triangulated trusses with anti-vibration rubber cushion bearers, each mounting truss attaching at the firewall at two points with expanding-bush bolts for quick release. The series 32 engine of the standard Prentice is carried well forward of the firewall so that adequate room is provided for accommodating the supercharger of the series 51 engine when this power unit is fitted. The difference in weight between the Queen 32 and 51 engines is but 50 lb, so that c.g. position will be affected very little.

Engine cowling is comprised in three units, a nosecap, two side panels and an under-tray. The port and starboard side panels are each piano-hinged to a ridge member running between firewall and nosecap, and can be opened in much the same way as the conventional car bonnet; in the open position they are braced by swing-away jury struts, and are locked when closed by eight quick-action fasteners on each side. The under-tray is a single-sheet unit in which is a longitudinal slot for emergence of the exhaust manifold: at its trailing edge the under-tray sweeps below the base curvature of the fuselage and so conveniently provides an outlet for the engine cooling air. A firewall of quite normal construction forms the front bulkhead of the fuselage, and serves to mount elements of the pneumatic system in addition to a ring of six flame-detector heads. In the latter connection it is worthy of note that these flame detectors serve only as a warning to the pilot (by lighting a lamp) in the event of fire: no provision is made for suppressing an engine fire and, presumably, the idea is that, if the aircraft is flying at too high an altitude to be landed safely before the fire grows to lethal dimensions, the occupants should "walk out." We cannot help but reflect that this contingency seems to offer only an extremely expensive alternative to the relatively small weight and cost penalties occasioned by fitting an automatic fire suppression system.

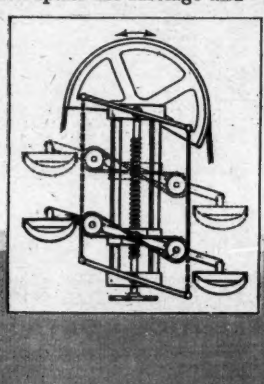




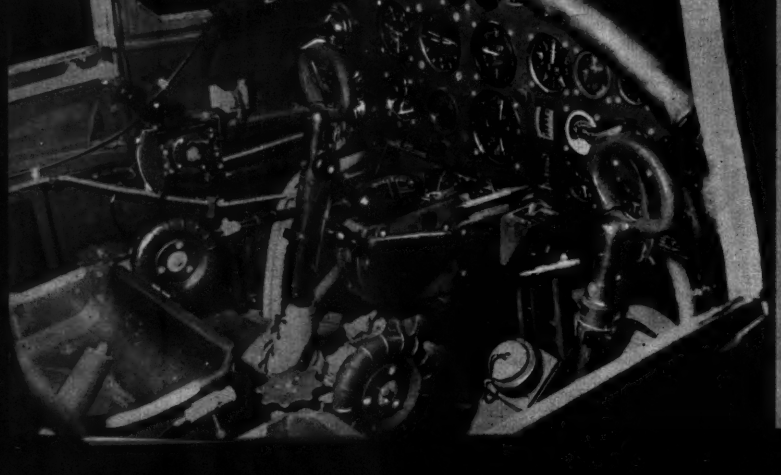
The amber "filter" screens for simulating blind-flying conditions are cleverly arranged to slide down ahead of the instrument panel when not required.

Although the fuselage from the firewall aft can loosely be said to be a semi-monocoque structure, this is not strictly accurate since that portion making up the cockpit is of sub-assembled panel construction, and the only part of the fuselage warranting the term monocoque is that which extends rearward of the after cockpit. Engine mounting pick-up points are forged end-fittings which form terminals both to the L-section bottom longerons and the built-up box-section top longerons, which latter also fulfil the functions of sill members to the cockpit canopy.

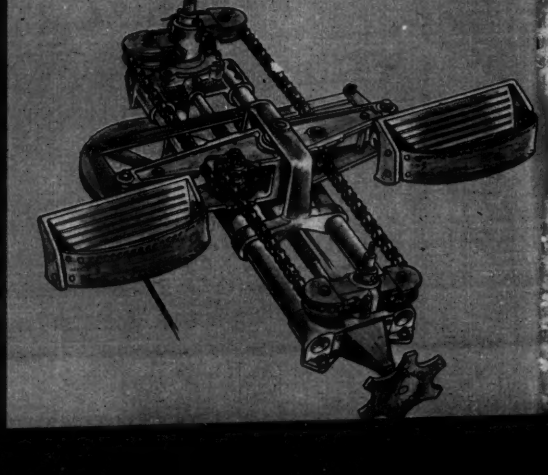
Between spar stations the base of the cockpit is taken up by a torsion box structure which spans the fuselage and bridges the spar pick-ups on each side. The top of this box defines the cockpit floor level although just forward of the front seats the floor slopes downward to meet the base-line of the firewall. From the front-spar bridge-member project forward



The cockpit provides dual flying- and engine-controls, but the blind-flying instruments are on the port (pupil's) side



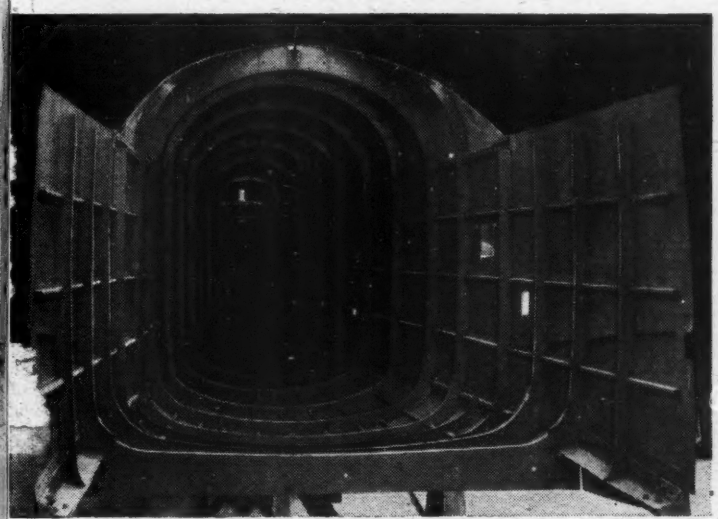
The Prentice rudder pedal units are capable of considerable adjustment whilst retaining parallel action and unchanged leverage.



The New Basic Trainer . . . . .

two light-alloy castings not unlike those sloping stools on which assistants sit when fitting one's shoes. These members support and accommodate respectively the rudder pedal assemblies and the control column assemblies: the latter are standard units but the pedal units are Percivals' own and strike us as being a useful development. The swing arm supporting the pedals is pivoted in a yoke member which is capable of being set, according to the leg-reach requirements of the pilot, within a range of about 2in; pedal movement is transmitted to the rudder control cable by an arrangement of chain and sprockets, the great advantage being that pedal leverage remains unchanged throughout the whole adjustment range, and static friction is small.

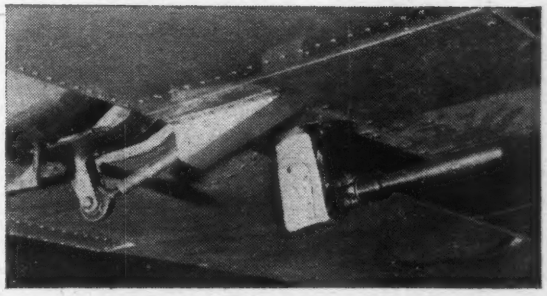
The top surface of the spar bridge-box is formed into a well which slopes back to a depth of about 8in at the rear. By this means the occupant of the rear seat is afforded foot room. The under surface of the centre-section box accommodates two doors about 15in long by 10in wide which give access to the interior. Forward of these doors is a single large access door which, hinged on its leading edge immediately abaft the firewall, gives access to the primary controls linkage.



View down rear fuselage showing panel-type semi-monocoque form of construction.

Dividing the front and rear compartments of the cockpit is a lateral rail of box form made up with channel-section side members tied together with top and bottom plates. This rail ties together the cockpit side panels and, on the centre line, is supported by a sloping box beam which, at its foot, attaches to the centre of the foot well in the centre-section bridge-box. From this point to the top boom of the rear-spar spanning-member rearwardly extends a tubular strut to act as a compression/tension member in taking the reaction of the flap jack mounted behind the spar. The sloping box-member just mentioned provides the central support for the lateral tubes upon which the front seats are pivoted; the seat backs have swinging link anchorages to fork brackets carried on top of the lateral tie rail. This arrangement provides rigid mounting whilst permitting a useful range of vertical adjustment for each seat.

The rear fuselage is a plain semi-monocoque of Z-section stringers for which the channel-section frames are notched, attachment between the two means of stiffening being provided by shear cleats. This part of the aircraft is also built up sub-assemblies of side panels, floor and roof panels, which are joined together by riveted lap joints on each frame: a guise of monocoque structure which is seldom used, but which has much to offer on the twin scores of rapidity and reduced cost of construction. In the tail cone of the fuselage is a built-up box frame in which are carried the two forged brackets to which complementing forgings on the base of the tailplane front spar are laterally bolted.



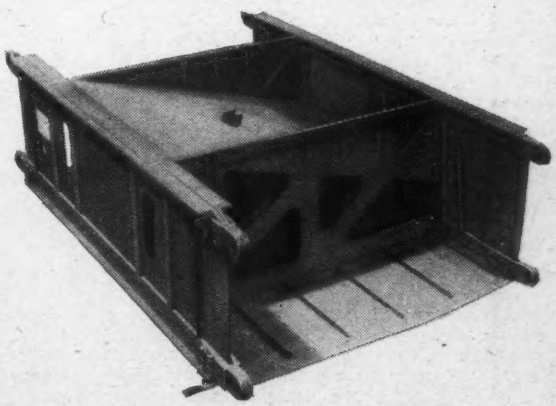
The pitot head is mounted close beneath the starboard wing at about mid-aileron span.

The rear spar of the tailplane is attached to the fuselage at a single central point, the pick-up being a T-bolt and trunnion whereby tailplane incidence may, if necessary, be varied; there is, however, little likelihood of this being required unless some radical change in weight distribution is made.

Tail Structure

The tailplane is built up around the two plate-web spars with interspar diaphragm-type ribs spaced alternately with lipped-angle contour members. Bracing the three attachment points a pair of diaphragm ribs are splayed in a V about the centre line. Transference of attachment point loads into the surrounding spar structure is made with forged fittings to which the pick-up anchorages are through-bolted with the spar boom. The spars themselves are substantially alike, differing only in boom details. Local reinforcement to booms is applied by ribbon-extrusions, and the free flanges of booms are machined off progressively outboard.

The fuselage terminates with a stern post in the form of a diaphragm pierced with lightening holes: registering with this, and through-bolted with it, is the base extension of the fin rear post. The raking front post of the fin is attached at the foot with a forged end-fitting incorporating



Part skinned centre-section spar bridge-box showing spar structure and fork/lug wing-attachment points.

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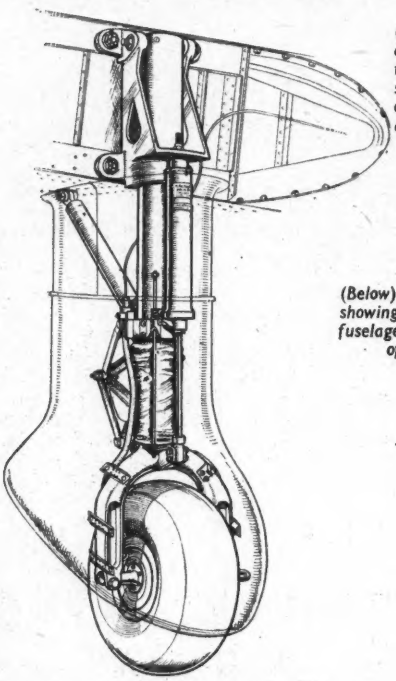
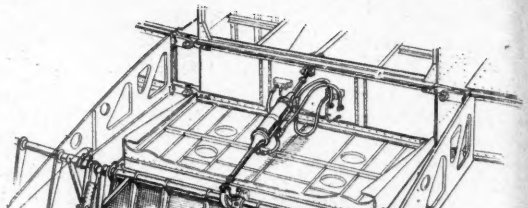
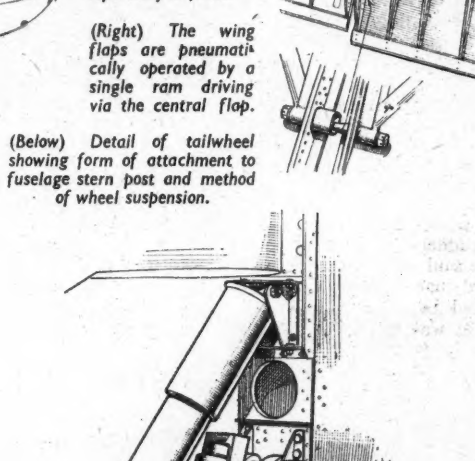


(Left) Undercarriage design is unusual in that the spring is in the telescopic strut whilst the oleo-pneumatic shock absorber is mounted separately in front.



(Right) The wing flaps are pneumatically operated by a single ram driving via the central flap.

(Below) Detail of tailwheel showing form of attachment to fuselage stern post and method of wheel suspension.



a pair of lugs which marry with the pick-up forks: these latter are through-bolted to the top-booms of the tailplane front spar. Each of the fin posts is a light lipped-channel-section member with swaged lightening holes, and the chordal bracing takes the form of diaphragm pressed-ribs. Similar former members brace the leading edge, and the trailing edge is a crescent-section, light, pressed shroud for the rudder nose.

Moving up toward the front end again we must devote some attention to the canopy and screen arrangements. The canopy is large and is so designed as to provide a means whereby the pupil pilot can be "blind" yet the instructor sitting at his side can see. This is achieved by the simple expedient of using amber-stained glazing in the canopy, and having the pupil pilot wear blue-tinted goggles. The instructor can thus see quite normally with the single exception that his view is amber-tinted. Since the amber screens are, in effect, filters, the blue "filters" worn by the pilot allow him to see everything in the cockpit but do not permit him to see a single thing outside—an example of simple applied spectroscopics.

The front screens are glazed with clear glass, as are the flanking screens, these latter being arranged to open as direct-vision panels: for such purpose they are ball/socket pivoted at the lower forward corner, and locked shut by a quick-lead screw at the top. An arcuate guide on the top of the hood over the instrument panel locates the swing-away movement, and each screen is held down, when open, by a spring-loaded jury strut on top of the hood. The solution to the problem of having clear glass for ordinary work and amber for simulating night flying is met in a simple way which is well in character with the general concept of the Prentice. The front screen-framing incorporates channels in which secondary interior screens are arranged to slide so that, when required, these amber-stained screens can be slid upward and latch-locked into place. A clever refinement is that the amber for the flanking D.V. screens is provided by secondary panels hinged to the sliding front-screen units; these flanking panels are each fixed in the open or stowed position by single turn-buttons.

Sides of the canopy are arranged to slide rearward from alongside the front seats, and so provide access. The top glazing of the side screens is amber, but the side glazing is divided vertically into front and rear panels, the rear panel being amber, whilst the front panel is clear; this, however, can be "filtered" by a secondary internal panel which is slid forward. Access to the rear cockpit is via a panel to port which is opened by sliding it upward and over to starboard. In an emergency the rear passenger could escape through this panel, or alternatively, has room to go forward and out through the jettisoned front portion of the canopy: both sides of the canopy are simultaneously jettisoned by a single central lever above the front screens.

We have already referred to the spar bridge-box which serves as a centre-section in spanning the fuselage and provides anchorage points for wing attachment; pick-up is with fork-and-lug boom end-fittings pin-jointed horizontally together. The spanning members are similar to the spars they unite, front and rear spars both being of plate-web and extruded angle-boom construction, although the gauges of the rear spar components are slightly the lighter. Boom extrusions include ribbon reinforcing strips which extend outboard for approximately half each semi-span and, in conjunction with this "tapering" the free flanges of the booms are also machined away progressively outboard, although sectional thickness remains constant. Interspar chordal ribs are primarily Warren-girder pressings with integral swaged stabilizing; these are spaced between lipped-angle-section contour members in groups of three.

Unusual Assembly

The leading-edge nosing is a top- and under-surface wrapping around pressed channel former ribs; in way of the ailerons the leading-edge ribs change, however, to diaphragms. Aft of the rear spar the flap shroud-ribs are light pressings profiled for flap retraction. In way of the ailerons the trailing-edge ribs are pressed diaphragms, the flanged ends of which support the crescent-section shroud for the aileron.

Although, as may have been gathered, the basic structural form of the wing is quite orthodox, it is, we feel, of interest to record that the method of construction is equally unorthodox. Leading edges and trailing edges are built up as sub-assemblies on their respective spars, then fitted into a jig and united by the chordal inter-spar ribs, finally to be skinned. It is also worthy of note that, apart from

a small area at the wing root and beneath the walkways, the wings dispense with the use of stringers.

Crash-proof fuel tanks, each of 20-gall capacity, are housed in interspar root cells, and in the port wing root leading edge is carried the 4½-gall oil tank, immediately inboard of which is fitted the oil cooler. Before leaving the fuel system we should refer to the pumping arrangements: in each fuel tank is an electric booster pump which is energized when the cockpit fuel tank is turned on to select the particular tank—a useful innovation.

Ailerons are fabric-skinned, metal skeletons which, in structural form, are entirely similar to the rudder and elevators. A D-box leading edge is formed by a metal skin wrapping on a light channel spar, and from this extend lipped-angle pressed ribs to the trailing edge tube. In hinge areas the bracing is so arranged as to fan out torsional loads into the structure; again, in common with the other control surfaces, aileron hinges are self-aligning ball-bearing type units. Mass balancing is introduced in the leading edge out toward the aileron tip.

Having described aileron construction we have no need to repeat the same phrases for the rudder and elevator. We feel, however, that a word may be said on elevator shape. Briefly, initial flight trials disclosed that a certain amount of aerodynamic interaction occurred between rudder and elevator, so the profile of the latter was modified accordingly; this successfully eradicated the trouble.

The Prentice is equipped with pneumatically actuated split flaps which, built in port, centre and starboard sections, total only a fraction under 25 per cent of the gross wing area. As before noted, the pneumatic ram is anchored on the centre line of the centre-section rear spar, and is pivoted to a cast horn member itself rooted on the torque tube of the "fuselage" flap; the port and starboard flaps are driven by movement of the central flap, articulation between each being by ball/socket unions. Structurally, all three flaps are similar in having a tubular torque-tube spar to which are pinned Z-section ribs carrying the single (under) skin surface.

The keynote of simplicity so markedly repeated throughout the Prentice is made apparent nowhere more than in the landing gear. Main wheels are carried in forks at the base of simple, telescopic struts, but instead of the usual internal oleo system, these legs employ steel coil springs, and movement is damped by a separate hydraulic shock-absorber fitted parallel on the front of the leg. Leg mounting is by means of a cast bracket bolted on front of the front spar, the head of the wheel leg being located in a bore at the base of the bracket and secured by a transverse bolt at the top. This attachment is completed by a tubular radius strut behind, and the whole is enclosed by a trouser-and-spat fairing, each part of which is in fore and aft halves. The tailwheel is a friction-damped spring-unit giving levered suspension of the wheel, and is laterally bolted top and bottom to brackets themselves bolted to the fuselage stern post.

Power Plant Engineering

British Engine Firms' Self-contained Engine Installations

THAT the greatest single contribution made of recent years by aircraft engine manufacturers to the safety and reliability of aircraft has been their adoption of responsibility for the engine installation as a whole was the claim advanced by Mr. Frank Nixon, B.Sc., F.R.Ae.S., M.S.A.E., Rolls-Royce power-plant quality engineer, in his lecture to *l'Association Française des Ingénieurs et Techniciens de l'Aéronautique* in Paris on December 10th.

Mr. Nixon outlined the development, peculiar to Great Britain, which has led to the evolution of the self-contained power plant, comprising the engine itself, its mounting, the cooling and oil systems, the engine controls, the engine-driven accessories, and the cowling. The scheme was initiated by the British Air Ministry in 1937, and details were worked out by a committee of the S.B.A.C. during 1938. Standardized arrangements of controls and bulkhead were laid down, and complete installational interchangeability between liquid-cooled and air-cooled engines of similar power was achieved. During the war, the Bristol and Rolls-Royce companies produced power plants in large numbers. Originally the work came under the Directorate of Research and Development of Engines in the Ministry of Aircraft Production, but as the project grew, a Deputy-Directorate of Research and Development of Installations was formed.

Liquid-cooled Civil Engines

As an example of the scheme Mr. Nixon chose the Rolls-Royce Merlin, and outlined the evolution of the Lancaster from the Manchester via the adapted Merlin power plant of the Bristol Beaufighter. More than 35,000 Merlin power plants were produced in England during the war, the majority for the Lancaster bomber.

Concerning the Canadian-built Douglas D.C.4M. *North Star*, Mr. Nixon said that the power-plant installation in this class, which had already made more than 600 crossings of the North Atlantic, marked the entry of the liquid-cooled engine into that sacrosanct civil airline field hitherto powered exclusively by American radial air-cooled engines, but it was chosen because of the extremely arduous conditions encountered by T.C.A., which include the North Atlantic route, where ability to surmount icing conditions (at altitudes up to 25,000ft) is of great value, as well as the Montreal-Vancouver run, on which the Rocky Mountains have to be traversed. Moreover, the choice was made deliberately after a careful assessment of the behaviour of Merlin-engined power plants during two and a half years of experience over the North Atlantic in Lancaster and Lancastrian aircraft, when 1,255 crossings were made.

A noteworthy feature of all Rolls-Royce power plants is the extent to which the various functions have been brought under automatic control and servo operation. In the *North Star* power plant, for example, there are automatic controls for coolant temperature and pressure, oil temperature, mixture temperature and fire detection. Electric actuators under automatic control operate the main and auxiliary cooling flaps and the hot-air intake selector, while solenoids operate the slow-running cut-off and the supercharger gear-change mechanism. Other power plants, such as the Tudor, use electro-pneumatic rams instead of electric actuators.

Thus the pilot is relieved of the onerous, fatiguing and potentially dangerously distracting duties of controlling these functions of engine and power plant operation. At the same time it is possible to dispense with a flight engineer and reap the financial benefit of carrying one additional passenger, while maximum performance of the installation is ensured by eliminating the human element.

This contribution to ease and economy of operation, and indirectly to reliability, has entailed considerable effort on the design and development of the systems, many of which have been initiated by Rolls-Royce.

Fundamental Requirements

Mr. Nixon listed the fundamental requirements of the engine installation as follows, in the order of importance:—

1. Safety—ensuring freedom from accidents.
2. Reliability—ensuring freedom from unscheduled delays.
3. Performance—to achieve maximum speed for minimum drag, weight, and fuel consumption.
4. Long life—for economy of operation.

Power Plant Engineering . . . . .

5. Ease of servicing—for economy of operation and to reduce ground maintenance time, thus giving rapid turn-around and improving utilization.
6. Interchangeability—for rapid replacement.
7. Repairability—for economy of operation.
8. Ease of production—necessary for large-scale output.
9. Low cost.

The order shown referred primarily to civil airline operation. Mr. Nixon commented as follows:—

It is interesting to note how with the establishment of aerodynamics as an exact science it is mechanical design which now assumes the preponderant share of the desiderata set forth above. It is by recognizing this fact, and by bringing their own particular outlook to bear on the problem, that British engine builders have been able to do so much to raise the all-round standard of the installation.

Hucknall

Realizing that if the development of their aero engines was to proceed on sound lines, it would be necessary to know more about their behaviour in flight, Rolls-Royce set up an Experimental Flight Test Section at Hucknall in 1934. Starting with one hangar, three Service aircraft, and a small technical and flight staff, it grew in the next ten years to a fleet of 48 aircraft of all types, from the fastest fighters to the largest four-engined bombers, with a personnel of 1,500. 10,000 engine hours of development testing are carried out annually, flying contributing nearly half of this, the remainder being done on hangar stands.

This combining of the engine and installation problems has been of inestimable value. A sound basis had already been established, and during the war and since, it has been broadened and deepened, and research and development facilities have been continuously augmented.

When a new aircraft type is under consideration, the first prototype engine installation is often designed, built and flown at Hucknall, the finally developed arrangement being handed over to the aircraft designer when all problems have been solved and the performance raised to the highest pitch.

As an illustration of the range of the problems arising during the war years, engine manifold pressure increased from 6.25 to 30 p.s.i.; Merlin horsepower from 1,050 b.h.p. to 2,050 b.h.p.; speeds of fighter aircraft from 350 to 440 m.p.h.; and service ceilings from 32,000ft to 45,000ft. In addition, since the war, the life of the power plant between overhauls has been increased from 400 hours to over 2,000 hours.

The establishment at Hucknall functions as a self-contained unit, covering all stages from project design, through project research and development, prototype design and manufacture, rig testing, hangar testing and flight testing, to initial production of the finalized design. Situated a few miles away at Ilkeston there is a Production Department where bulk production follows on initial production at Hucknall.

At Hucknall there is an airfield having a runway of 2,000 yards, which is adequate for aircraft having an all-up weight of 80,000 lb. There is a small wind tunnel for the exploration of the design of ducts, air intakes, nacelle shapes, performance tests on elements of radiators, oil coolers, etc., and a larger one 5ft × 7ft 100 m.p.h. wind speed, for tests on scale models of complete aircraft, nacelles, cooling ducts, air intake ducts, etc.

The Rig Shops in the Project Department are among the most complete of their kind. To mention only a few of the rigs there are those on which it is possible to simulate the complete cooling system, the complete oil system, and the complete fuel system, of a wide variety of installational arrangements. Altitude effects (up to 60,000ft) on the various systems, and low-temperature effects on components and materials, can be explored. There are vibrating machines to test components varying in size from radiators to small control units. In addition, there are test rigs for every variety of automatic control, actuators, valve, etc., used on the power plants.

An interesting rig is that for conducting static tests on engine mountings. It is perhaps unique in being able to apply, simultaneously all eight leads viz., torque, thrust, vertical, lateral, and fore-and-aft inertia, pitching, yawing, and rolling couples.

In addition to the extensive flight-testing programme, covering both research and endurance flying, fire-extinguishing tests on complete aircraft are carried out. These latter check the ability of the fire-extinguishing system to cope with fires deliberately lighted and fed by oil and petrol from an outside source. Arrangements have also been made with the British and Canadian Governments to carry out winterization trials in Canada, by means of which most valuable information regarding operation at low temperature has been gained.

Full-scale Testing

Special silenced test hangars have been designed. The complete power plant is mounted, with its airscrew on a "wing" of streamline section, which is attached resiliently to the walls of the test house. The nacelle structure aft of the attachment points on the bulkhead of the power plant closely resembles that used in the aircraft, so that the vibration characteristics, and the slipstream effects, are similar to those likely to arise in flight. For additional cooling, a fan driven by an electric motor is installed ahead of the power plant. The "wing" may be inclined upwards or downwards to simulate climbing and diving conditions.

The controls, pipes, cables, etc., are led from their normal positions on the bulkhead via a tunnel inside the wing, through the wall, to a test panel in the cabin.

One test hangar is fully employed in carrying out type tests and development tests of long duration. Experience to date has established a close relationship between the behaviour of power plant components on hangar test and on flight test, and over 5,000 hours of development testing are carried out each year.

On the subject of maintenance of quality Mr. Nixon had many interesting things to say. He pointed out that during the war there was a great deal of petty unserviceability due to defects in cowlings, oil coolers, radiators and the like. The oil cooler was a good example of the results achieved at Hucknall. Until three years ago, the production acceptance test consisted of two cold static pressure tests and a heating to operating temperature, without pressure. The majority of failures occurred in the soldered joints. The most satisfactory production acceptance tests had now been found to comprise 5,000 cycles of pressure, varying from zero to ten per cent above the maximum working pressure, at 150 deg C. Detection of leaks had been made more certain by the use of a fluorescent compound in the test fluid. Leaks which were in the form of fine cracks in the soldered seams might retain a film of moisture from the washing process, and the surface tension of the moisture was sufficient to resist the air pressure acting over the small cross-section area of the crack. The fluorescent compound, usually fluorescein or anthracene, in the water became visible in ultra-violet light.

New Type-approval Tests

In parallel with the Production Acceptance Tests, new Type Approval Tests have been laid down. These call for 50,000 pressure cycles; a static pressure test of twice the maximum working pressure without serious permanent set; and a series of vibration tests combined with pressure cycling. The improvements achieved had been great, and almost without design changes. They were mainly due to an awareness of his responsibility by the operator, and to a revival of the old craftsman spirit.

Mr. Nixon concluded his lecture with the following summary of the advantages of the power-plant scheme:—

(1) The engine builder has a long tradition of *development by testing* behind him, which he applies to the power plant, with consequent improvement in reliability and life.

(2) He forms a common pool of knowledge and experience of the installation of his engine in a wide variety of

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aircraft, so that the standard of design and development will always be higher than the average of installations designed by a number of independent aircraft companies.

(3) This pooling of operational experience within one organization leads to the more rapid solution of problems, and establishes a consistent policy of development which leads to increased reliability and improved performance.

(4) There is considerable economy of overall effort in that the design, development, tooling, provisioning, manufacture, inspection and testing are carried out by one organization, thereby avoiding multiplication of staff and equipment. By the same token it is possible to install equipment for development and research which individual aircraft manufacturers would be unable to justify. Moreover, the engine power plant manufacturer is able to keep fully employed a staff of specialist engineers.

(5) The intimate contact between the engine and installation divisions of an engine company produces a closer mutual appreciation of the common problems, so that engines can be designed from the outset with the needs of the installation in mind.

At the same time there is a better appraisal of the performance requirements of the aircraft and the most suitable choice of engine rating can be made to suit the operational duties.

(6) The aircraft designer is relieved of all the worry of the power plant installation during his preoccupation with the design and development of the prototype aircraft.

(7) Similarly, the airline operator is relieved of the onus of maintaining contact with a large number of suppliers of such power plant components as cowlings, radiators, oil coolers, header tanks, actuators, controls and safety devices, fire-extinguishing equipment, pipes, cables, etc., etc. The engine manufacturer undertakes this responsibility and as in the case of the Rolls-Royce power plants in the "North Star" aircraft, vouches for their reliability by guaranteeing their life.

The experience gained is available for application to the installation of gas turbine engines, which is perhaps more intimately bound up with the design and layout of the aircraft than is that of the piston engine.

Test Pilots Together

Annual Dinner and Presentation at Farnborough

ALTHOUGH we and others have expressed regrets at the parting of the Empire Test Pilots' School and the College of Aeronautics, so cordially associated while sharing the R.A.F. station at Cranfield, the selection of Farnborough as the new old home of the test pilots' school is a very happy one and will be approved by all in view of the station's long standing and traditional association with test flying.

On the occasion of the characteristically excellent party given on Friday, December 12th, Air Marshal Sir Roderic Hill, K.C.B., M.C., A.F.C., M.A., F.R.Ae.S., himself one time test pilot at Farnborough, was the guest of honour at dinner. At many such functions speeches in any form are tolerated rather than welcomed, but each year at the test pilots' dinner guests look forward to the mixture of sound comment, advice and humour which is invariably forthcoming.

The P.M.C., Cdr. F. M. A. Torrens-Spence, D.S.O., D.S.C., R.N., introduced G/C. S. R. Ubee, A.F.C., the Commandant of the school who started by welcoming guests who represented an almost unique cross-section of aeronautical science. He also thanked the industry, Boscombe Down, the R.A.E., and the College of Aeronautics for their help to the course, visits to factories, etc., and there and then before proceeding, the Group Captain, staff and present students in a very pleasant gesture, drank to the visitors.

No. 6 course was now reaching a successful conclusion, said the Group Captain, in spite of the two months' hiatus and all the troubles associated with the move from Cranfield. The pupils had attended the rescue and survival course at Thorney Island during this break, and, it seemed, had thoroughly enjoyed six weeks in tropical conditions. During the next few weeks conversion of the school's new quarters would be completed.

The course had achieved a new high in flying hours, and the average per pupil, which reflected individual enthusiasm, is 100 hours. G/C. Ubee said that it had been very gratifying to see so many graduates of previous courses taking part in the S.B.A.C. display this year. Of his hard-working staff he singled out Mr. G. McLaren Humphreys, the chief technical instructor, for special praise. He had "carried the torch of learning with great effect" and successfully convinced even the sceptics that there was in fact a connection between the equations of the classroom and the aircraft in flight. The Group Captain's excellent right-angle (and left-angle) story will be remembered by all.

For F/L. Fred Arnold, the adjutant, this dinner for the sixth course was a swan-song function. The Commandant described F/L. Arnold as a remarkable character who at well over fifty years of age had become an air gunner because at the early stage of the war he had thought it the best job he could do. Fred Arnold was presented with a handsome silver cigarette case. Continuing on a personal note, G/C. Ubee congratulated three pupils who, as well as coping with the course had just got married or were about to be. These three received presents in recognition of their "endurance." They were F/L. D. G. McCall, F/L. G. T. Chandler and F/L. S. McCreath.

Finally, before calling upon Air Marshal Sir Roderic Hill, whose career he described as a great example to all, the Commandant thanked G/C. Sylim Roberts for the provision of the mess and personally congratulated S/L. R. W. Whittome, O.B.E., D.F.C., this year's winner of the McKenna Trophy.

There was then a brief interlude for the annual ceremony of the headmaster's titfer.

Air Marshal Sir Roderic Hill commenced by recalling that many great men had been associated with Farnborough since the old days, and that the speeds of aircraft were now four or five times that of the aircraft he and they had used. The Air Marshal expressed his admiration for the work of the Wright brothers who, he said, succeeded by a combination of practice in the field and laboratory work such as it was in those days. The brothers had made a tremendous contribution which we had emulated in following years not without success.

The evening's gathering indicated a combination between the pilots of the Air Force and industry in one union, one club. The ground was just as hard for both regardless of uniform! He thought the school for breeding test pilots was of tremendous importance to the nation, and had a significance far beyond its immediate purpose. We were on the fringe of great changes that would take place in the world during the next thirty or forty years, and needed a calm, courageous outlook to face it.

Sir Roderic then recalled that G/C. McKenna had served for a while under him in America, and said he had been a great man and his death a great loss. He congratulated S/L. R. W. Whittome on being head of the No. 6 course and therefore the recipient of the McKenna Trophy. He referred to S/L. Whittome's fine record in Coastal Command, and said that he understood that he originally flew Londons, in which case he was "practically in sail."

S/L. Whittome himself was prevailed upon to speak, and said that he appreciated the honour of the award, especially as it was made by Sir Roderic Hill, but he felt that all members of the course worked so hard that each should have received a McKenna Trophy. He spoke also of the value of discussion and argument among the members of the course, and said he himself had learned a lot in this way. It is understood that S/L. Whittome will probably remain at Farnborough as an experimental pilot with the R.A.E. The runners-up on No. 6 course were Lt. Cdr. G. F. Hawkes, R.N., and F/L. J. S. R. Munner-Roland, D.S.O., D.F.C, of Fighter Command. The course included two Canadian, one Australian, one South African and two American pilots.

The final speaker who was called to his feet was F/L. Fred Arnold, who recalled many incidents and personalities since No. 1 course. He added that the fact that the school was able to welcome 167 guests from all over the world indicated that it had made its mark. Among the visitors from previous courses were Cdr. Bergerhaut and Capt. Sonderman (now Prince Bernhard's pilot), who had come over specially for the dinner.

H.M.S. KESTREL PAYS OFF

LAST Friday, December 12th, before Her Worship the Mayor of Winchester (Councillor Mrs. Doris Crompton), Vice-Admiral R. H. Portal, C.B., D.S.C., Rear-Admiral (E.) J. L. Bedale, C.B., and the citizens of Winchester, the major part of the Ship's Company of H.M.S. "Kestrel" marched past with a precision and smartness akin to that of "Whaley". After Her Worship had graciously taken the salute, Vice-Admiral Portal, with admirable brevity, said that the march-past marked the close of an era during which more than 2,000 telegraphist air gunners and over 10,000 engineer officers and air mechanics were trained. Both the Vice-Admiral and Her Worship the Mayor could not resist recalling the late Lord Haw-Haw's proud claim that H.M.S. "Kestrel" had been sunk.

The Mayor concluded by expressing the affection in which Winchester held her link with the Royal Navy. Captain H. Geary Cooke, R.N., the Station's present Commanding Officer, stressed the part the personnel of the Royal Navy play as unofficial ambassadors in foreign countries. He concluded by thanking Winchester for all that it had done for Worthy Down and the part it had played in making it the happy ship that it had always been.

That evening officers of nearby R.A.F. stations and Army units were wined in the wardroom, while Winchester itself was able to see "Hail and Farewell," a non-stop revue given by members of the Ship's Company.

CIVIL AVIATION NEWS

AIR OMNIBUS : The Silver City Bristol Wayfarer, in nine days' flying between India and Pakistan during the recent evacuation of refugees, carried 1,105 passengers with about 44 lb of baggage each. On one flight 117 passengers were carried, and in one day 151 men, women and children travelled in the Wayfarer. The aircraft operated within its limiting all-up weight of 37,000 lb.

Six Months of Successful G.C.A. Operation : U.S. Airline Operating Costs Rise : Italian Airline Routes

AMBASSADOR REPAIRED

IT will be remembered that the prototype Ambassador had an unfortunate mishap on November 22nd when a landing was made with the starboard undercarriage leg unlocked, with consequent damage to the underside of the fuselage. The repairs were completed on Saturday, December 6th, but the company had taken the opportunity, during the time the aircraft was grounded, of making several modifications, and they were completed on December 10th. The primary cause of the undercarriage failure has been established, although the exact sequence of failure is difficult to determine. The initial fault, however, was structural, in that the bolts holding one of the jack-supporting tripod legs failed, leaving the jack partially free. Thereafter the uplock was opened, the downlock closed prematurely while the leg was falling, and the hydraulic line was pulled away. The fact that the aircraft has been repaired and is flying again so soon after the accident indicates that the damage sustained was relatively slight. Mr. Errington must be congratulated on his masterly handling of the aircraft in the difficult circumstances, as also must the experimental team which have worked so hard making the necessary repairs. Undoubtedly the high wing design was largely responsible for the avoidance of damage to the starboard wing and engine.

SUCCESS OF G.C.A.

AFTER some procrastination by the Ministry of Civil Aviation last winter of which due criticism was made by *Flight*, Ground Controlled Approach radar was installed at London Airport. A Royal Air Force crew and "Bendix" G.C.A. equipment from Prestwick was loaned to the M.C.A. by the Air Ministry on February 7th, 1947, and arrangements were made for the R.A.F. to train a number of civil crews. At the same time "Federal" G.C.A. radar units were obtained. The first civil crew started training on January 6th, and since that date eight complete crews have been trained and a further six are still under training. The Ministry established a G.C.A. Training School at Aldermaston on October 27th, and the first three crews to be trained by that unit completed their courses on December 14th. The first R.A.F. crew was supplemented by a civil crew on May 7th and the M.C.A. took over complete operation of the equipment at London Airport on July 1st. Up to December 2nd, 1,012 operational and practice G.C.A. approaches had been made since the M.C.A. took over.

Experience has shown that captains of aircraft are enthusiastic about its operation and some have refused to land in conditions of bad visibility without using the equipment. Certain Continental companies have sent special aircraft and airline captains to London Airport for intensive training and little language difficulty has been experienced. The authorities have found that G.C.A. avoids stacking and allows approaches to be made in conditions which would be substantially poorer than those in which pilots would use normal instrument approach aids. In fact, the limit is down to about 200 yards visibility and 200 feet cloud base. The G.C.A. approach and landing takes approximately 10 min., which compares favourably with procedures for I.L.S. and S.B.A., which average 15 and 8 min. respectively. It has also been invaluable for monitoring aircraft using the other aids, has enabled Air Traffic Control to ascertain the traffic pattern in the Metropolitan Control Zone, and also to check that aircraft are flying the safety tracks passed to them.

SCOTTISH AIRFIELDS

A. CDRE. J. G. MURRAY, Controller of the Scottish Division of the M.C.A., stated after a recent meeting of the Scottish Aerodromes Board that G.C.A. would be reinstalled at Prestwick by the end of this month and that work was to be started on the strengthening of runways at that airport by next spring, and would be completed by the autumn. He also disclosed that a survey was being made for an airfield on the Isle of Mull and that feeder services would be started from Errol airport, Perthshire, in the spring. There was no question of an alternative to Turnhouse being found.

CONSTELLATION SLEEPERS FOR T.W.A.

TO serve its overseas routes, Trans World Airlines have ordered 12 Constellations for delivery between February and June, 1948. These new aircraft will have long-type cabin seats convertible into 20 upper and lower berths and reversible,

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so that party groups may sit facing each other. As the new Constellations go into service, they will replace existing ones without sleeper accommodation which will be transferred to Transcontinental and Western Airways for domestic services. T.W.A. plan to fly the new aircraft on the New York-Paris route without a refuelling stop at Gander or Shannon. The order brings the fleet of T.W.A. up to 132, and includes 34 Constellations, 15 DC-4s (all in overseas operation), 5 Stratoliners and 78 Dakotas.

AIRCRAFT TYPES FOR THE CORPORATIONS

WHEN Mr. John Freeman, Joint Parliamentary Secretary to the Ministry of Supply, gave a written answer to a question in the House recently, he said that twelve types of aircraft were on order for the three Corporations. This total is presumably made up by the Brabazon I, D.H.106, Hermes, Tudor, Viking, Marathon, Concordia, Solent and Sandringham, S.R.45, S.51 helicopter, and either the Viscount or the Ambassador.

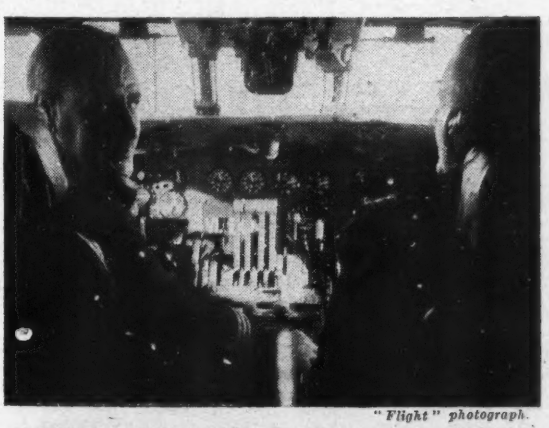
U.S. AIRLINES INCOME DOWN

PASSENGERS, mails and freight carried by American airlines in the second quarter of 1947 showed increases over the figures for the same quarter in 1946. Though revenue rose, operating expenses rose faster. For the year ended June 30th, 1947, the net loss for the internal airlines was $22½ million. The following figures are issued by the C.A.B.:—

	Three months ending June 30, 1947	June 30, 1946
Revenue-miles flown	79,178,058	76,800,973
Operating revenue		
Passenger	$82,028,485	$71,376,930
Mail	5,618,233	4,504,754
Express	2,698,456	1,930,300
Freight	1,742,879	731,030
All other	1,856,860	1,219,480
Total	93,944,913	79,762,494
Operating expenses	91,162,368	74,524,952
Net operating income	2,782,545	5,237,542

B.E.A.C. BRITISH DIVISION

A SINGLE Division has been formed to operate internal services in the U.K., out of the English and Scottish Divisions of B.E.A. previously based at Speke and Renfrew. The new organization will be known as the British Division, and have headquarters at Renfrew. The general manager is Mr. G. O. Waters, who was, of course, manager of the English Division. Mr. A. H. Millward will now be known as the general manager as distinct from manager of the Continental Division. The British Division of British European Airways Corporation is, to say the least, a clumsy title, and one wonders how un-British are the other departments in B.E.A. and the other Corporations. The general manager presumably did not favour the title 'United Kingdom Division," since he would then be known as M.U.K. Perhaps "Home" or "Internal" division would have been a better choice.



"*Flight*" *photograph.*

AUSTRALIAN CONSTELLATION: Captain Macmaster, chief pilot of QANTAS Empire Airways flying the Gold Plate Constellation "Charles Kingsford-Smith." This aircraft left Sydney on December 1st to fly the first through scheduled flight to this country.

QANTAS OCCASION: Sir Harold Hartley, Chairman of B.O.A.C., Mr. J. R. Stewart, London Manager for QANTAS, Lord Nathan, Minister of Civil Aviation, and in the background Mr. Peter Masefield, at a QANTAS Empire Airways party in London on December 5th.

THE S.A.S. FLEET

SOME figures of the operation of S.A.S. (Scandinavian Airlines System) since it was formed jointly by D.N.L. (Norway), D.D.L. (Denmark), and S.I.L.A. (Sweden) have been received. Formed on August 1st, 1946, to operate first North Atlantic and then South Atlantic services, S.A.S. flew 2,528 passengers in the first quarter of 1947 and its fleet now consists of 7 Douglas DC-4 aircraft (D.D.L. 2, D.N.L. 2, S.I.L.A. 3). On order for S.A.S. are 7 DC-6s (D.D.L. 2, D.N.L. 2 and S.I.L.A. 3) and also 4 Boeing Stratocruisers (D.N.L. 1, D.D.L. 1 and S.I.L.A. 2).

AUSTRALIAN AIRLINE BATTLE

AN amendment to the Air Navigation Bill in the Australian Parliament seeks to give the Director-General of Civil Aviation power to refuse a licence for airlines to operate to the Northern Territory. If it becomes law, Guinea Airways may be prevented from competing with Trans-Australia (the Government airline) on the Adelaide-Darwin route. Guinea Airways pioneered this route ten years ago, and T.A.A. commenced running the same route on November 1st this year. The Bill also seeks to authorize charges for the use of airfields and facilities set up by the Government.

In recent issues *Flight* has reported the controversy between T.A.A. and Ansett Airways on the question of rates, which Ansetts have refused to raise to T.A.A. levels. The airline has met threats of restriction with the claim that the country's constitution prevents restriction of inter-state trade, and the new amendment would, therefore, modify a part of the constitution protecting privately owned airlines.

Recently Ansetts lost their £A25,000 annual subsidy for running country services; serving, that is to say, rather out-of the way areas. The grounds for withdrawal were that a Melbourne-Hobart service had been operated without a licence as part of combined aircraft-coach tours of Tasmania.

GREEK PENSION FUNDS TO RUN AIRLINE

A NEW Greek airline, Hellenic Airlines (Hellas), has been formed as a result of agreements between Scottish Aviation, Ltd., which holds 40 per cent of the shares, and the pension funds of the Greek Navy, Army and Air Force, which hold 60 per cent. The British company will supply technical and administrative staff and at the same time recruit and train, at Prestwick, Greeks who will gradually take over until ultimately Hellas will have an all-Greek staff. The new airline will operate external and internal services. The participation of pension funds in an airline is unusual. In Greece, however, *Flight* hears, Metchikon Tameion, the Services' fund, has wide commercial interests, and owns among other things the largest office block in Athens. Servicemen pay contributions, the accumulated capital is invested, and pensions, as well as charitable grants where necessary, are paid out of profits. The existing Greek airline, T.A.E., is run jointly by Greek commercial interests and the American T.W.A. company.

Hellas will commence with services between Athens and Larissa, Salonika, Crete and Rhodes; a London-Athens service,

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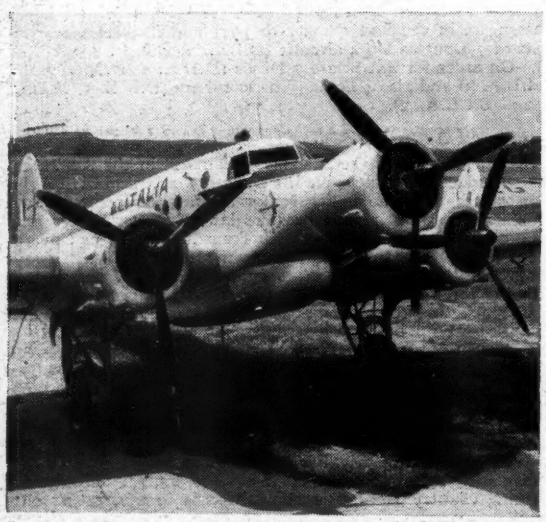
and later on services between Athens and European and near-Eastern capitals. General Tsarpalis, of the Royal Hellenic Air Force, is managing director and Mr. T. Hope, operations manager of Scottish Aviation, will be co-acting managing director.

ALITALIA'S SERVICE PLANS

FROM time to time we have reported the progress of Alitalia, Ltd., formed in 1946 by B.E.A. and Italian interests, and the commencement of services to Sicily, Tripoli and the major Italian towns. Alitalia now announces a programme which, when it is carried out, will mark Italy's re-entry into international civil aviation. Services from Rome which are planned comprise: to Vienna and Prague; to Madrid and Lisbon; to Copenhagen and Gothenburg, via Milan, with possible stops at Stuttgart, Buckeburg or Hamburg; to London; to Brussels and Amsterdam; to Lisbon or Tripoli and on to South America; to Cairo and the Middle and Far East, either via Cairo only or via El Adem and Cairo; to Athens and the Middle and Far East (the Rome-Athens leg in conjunction with L.A.I.); to Paris; Geneva; Milan-Manchester; and to Cairo, Khartoum, Asmara and southwards.

FLUID FOR T.K.S. DE-ICING

T.K.S. (AIRCRAFT DE-ICING), LTD., wish to make known to operators of aircraft equipped with the T.K.S. de-icing system that the only de-icing medium recommended by them for use therein is T.K.S. fluid R.328, or H.63A in the case of aircraft fitted with a combination of T.K.S. porous metal distributors and the fabric wick-type overshoes. The company state that a number of fluids have been made available for use in the T.K.S. de-icing system and they have been tested for suitability. T.K.S. have not, however, approved them. It is considered that the use of any other fluids, such as D.T.D. 406A, will have an adverse effect on the de-icing efficiency of the system, due to their comparatively high surface tension characteristics and therefore their inherent inability to give the desired spread from the porous metal distributor. Any doubt that may have arisen as to the approved type of fluid to be used may have been due to "Notice to Licensed Aircraft Engineers and Owners of Civil Aircraft" No. 20, mentioned in *Flight*, July 31st, 1947, which permitted the use of fluid D.T.D. 406A. Approval for the use of fluid D.T.D. 406A was, it is understood, given reluctantly by the company as a temporary measure between the withdrawal of H.70 and the introduction of R.328, and they wish to make it clear that fluid D.T.D. 406A was not at any period approved by them in lieu of H.63A.



MARTIN 2-0-2 GROSS WEIGHT

TESTS with Pratt and Whitney water-injection type engines on the Martin 2-0-2 under Civil Aeronautics Administration supervision are reported to have resulted in the aircraft passing all tests for certification for a gross weight of 39,900 lb. The C.A.A. is checking the data before giving final approval. Originally this aircraft was certified for 38,000 lb, and the new figure, if approved, would enable 300 gall more fuel to be carried. At 39,900 lb C.A.A. would require a maximum take-off length of 1,173yd, but without water-injection and at an all-up weight of 38,000 lb maximum take-off requirements were for a 1,209yd runway.

BREVITIES

Westminster Airways, Ltd., have closed their Croydon office, now that the firm's flying activities are based at Blackbushe airfield, Surrey. The London office at 78, Buckingham Gate, S.W.1, remains open.

* * *

A Qantas Lancastrian made a proving flight to Tokyo recently and it is expected that a twice-weekly service on a charter basis for the Royal Australian Air Force will commence in January, 1948.

* * *

When K.L.M. introduces Constellations on the Amsterdam-Johannesburg service on December 18th, flying time for the 6,500-mile route will be reduced to 37 hours, from the present 48 hours. One overnight stop is to be omitted.

* * *

A cable from India reports that the Minister of Railways and Transport has announced a plan to start air services to Britain in May next year. This presumably refers to the proposed services of Air-India International, Ltd., formation of which on a joint basis by Air India and the Indian Government was recorded in *Flight*, November 20th.

* * *

On December 8th Cyprus Airways, the formation of which by B.E.A. and local interests was announced in *Flight*, November 20th, operated its first London-Cyprus flight. The company has three passenger or freight dual-purpose Dakotas, converted by Scottish Aviation, and the company is based at Nicosia airfield. Later, services are to be run to Alexandria, Cairo, Palestine, Syria, Rhodes, Smyrna and Istanbul. The London-Cyprus route, the fare for which is £65 single, £117

ITALIAN FLEET: By the end of this year the Alitalia fleet of aircraft will consist of five SM 95s with Bristol Pegasus engines, five Fiat G 12 Ls with the same type of engine, and four with Alfa-Romeo engines, five Lancastrians and one Lancaster.

The close-up photograph is of a Fiat G 12, and on the right some of the fleet are seen at Urbe airport. The G 12 was designed during the war as a military transport, has since been converted for airline use and with a lengthened fuselage carries eighteen passengers and baggage.

Civil Aviation News . .

return, includes stops at Marseilles and Athens and a night stop at Rome.

* * *

During 11 years of operation Australian National Airways have carried 1,590,000 passengers and have flown 71,500,000 miles. During the first year of operation, 1936, 7,265 passengers were carried, and last year 470,000 travelled in the company's aircraft.

* * *

A deputation of M.P.s who have formed a N.E. Joint Airport Committee, has been informed by Mr. Lindgren that West Boldon is to be adopted as the main North-Eastern airport. This does not mean, it is understood, that work will now start, but it does mean that the site will be scheduled and earmarked under the Town and Country Planning Act. Last week we referred to Newcastle Council's decision to postpone consideration of major improvements to Woolsington.

* * *

CLUB CHIPMUNK: Mr. C. S. J. Ashley, chief instructor of Loxham's Flying Services Ltd., giving dual instruction over Blackpool in the company's first Chipmunk. Loxham's have ordered altogether three of these Canadian D.H. trainers.

The second assembly of I.C.A.O. is to be held in the Palais des Nations, Geneva, and is to begin on June 1st, 1948, lasting about three weeks.

* * *

At a conference of postmasters-general held in India it was decided to make arrangements to speed up air mail services and to launch a campaign to restore the efficiency of the services affected by partition.

* * *

Gibraltar (North Front) airfield is under R.A.F. control, and Notice to Airmen No. 356 of 1947 gives details of the procedure necessary for non-scheduled flights using the airfield.

* * *

Pan American Airways have reduced the sleeper fare on their non-stop service between New York and London by $25 to $100. This is a supplement to the ordinary fare of $325.

* * *

Two new positions for Assistant Safety Directors have been created by the American C.A.B. One is to take charge of safety regulation, the other is to supervise accident investigations. Until the post of Safety Bureau Director is filled, the new officials will report directly to the C.A.B.

* * *

Notice to Airmen No. 355, 1947, includes a list of Met. stations giving services available to civil pilots in the U.K., and the categories into which they fall. The same notice cancels No. 226 of 1947.

* * *

Aer Lingus has made its first post-war increases in fares on services to London, Liverpool, Glasgow and Manchester. The new rates amount to 11½ per cent more on the existing Dublin-London single fare and are 31.7 per cent higher than pre-war fares at £7 3s. The old rate was £6 10s.

* * *

Air cargo rates between the U.S.A. and the principal cities of South America served jointly by Pan American World Airways and Pan American-Grace Airways ("Panagra") have been reduced. On shipments of over 100 lb, rates will be 36 per cent lower and on smaller lots there is nearly as substantial a reduction. It is expected that many traffics will be brought within the economic limits of air transport and that ton-mileage increases will be substantial.

* * *

Bishop's Court airfield is to be handed over by the R.A.F. to be used as an alternative airfield to Nutt's Corner, Belfast, in bad weather. B.E.A. are to provide passenger handling facilities.

* * *

British South American Airways have new administrative headquarters in London at Starways House, King Street, St. James, S.W.1 (Whitehall 4366).

* * *

Cable and Wireless, Ltd., have been having trouble with the addresses on telegrams sent to passengers at airports, and are asking that such addresses should contain the word "passenger," the name of the airport and the airline concerned, together with the flight or trip number.

* * *

The strike of Swedish Airlines employees, which started on November 28th after a month's negotiations had broken down, is expected by the President of the airline, Capt. Carl Florman, to last as long as two months. The strikers demand considerable wage increases, free working clothing and a 40-hour week. Foreign airlines are to continue to run to Sweden, but the airport buses to Stockholm, four miles away, are not running.

* * *

United Air Lines has asked the American C.A.B. to increase its air-mail rates from 45 cents a ton-mile to 2.26 dollars for this year, retrospective to January 1st, and 1.25 dollars for 1948. This amends an earlier petition asking for a one-dollar rate. U.A.L. says that the 5-cent air-mail postage was established during the war, when 20 million ton-miles of mail a year was handled. This has now sunk to an estimated 9 million ton-miles, while costs have risen. A loss of approximately 2½ million dollars is forecast for the whole of 1947 operations, despite high passenger and freight load factors.

FROM THE CLUBS

The annual general meeting of the United Services Flying Club was scheduled for December 15th, at Elstree airfield, with tea and a "race meeting" to follow.

* * *

During 1947, over 1,000 hours were flown without mishap by the aircraft of the Midland Bank Flying Club and the year ends with the obtaining of the club's 50th post war "A" licence, while the more advanced of the *ab initio* members are up to the standards of cross-country flying and aerobatics.

* * *

Since December 15th the Plymouth and District Aero Club has had the use of the whole of its pre-war clubhouse, which has been vacated by the R.A.F., and in future the club will be open on Mondays as well as the other days of the week. Membership has passed 300 and is increasing, and in August 230 hours were flown with the club's aircraft, which consist of two Austers, a Fairchild and a Tiger Moth. This summer, one of the Austers was flown to Geneva by a member, and the same member flew there again in the Fairchild, which was also flown to Brussels twice and to Amsterdam. Although rates for the Austers and Tiger Moth remain at £3 an hour and for the Fairchild at £5, the "fly yourself" hire enables members to share the cost and to make long journeys at less than the ordinary airline fares.

* * *

In spite of the November weather and the shortening days, the Cambridge University Aero Club flew 94 hours in the brighter and less gusty spells, and during the month five *ab initio* members and five experienced pilots became members. Several members have taken advantage of the night flying and instrument flying facilities available.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

WOMEN PILOTS

"Paid to be Careful, Not Brave"

IN reply to your correspondent, Mr. F. S. Symondson (*Flight*, December 4th) may I start by saying that I was privileged to serve in the W.A.A.F. prior to my secondment to the A.T.A., and though the Service was my first loyalty, I must in all honesty confirm that there were innumerable instances where women demonstrated their equality and, on occasions, their superiority.

With all due deference, a pupil knows more of the mental attitude of his or her workmates than any instructor, and there was a definite tendency among ex-R.A.F. seconded personnel to regard the A.T.A. as an effete and drone-ridden organization from which they could learn nothing they did not already know. Anyone who was employed on taxi duties has vivid and bitter memories of dreary hours spent sitting in Flying Control while some super "birdman" with silver wings transmuted into gold did a square search over England for his missing destination.

Concerning Mr. Symondson's remarks on weather and how ex-R.A.F. *flew* (sic), perhaps he does not know that, in 1945, three very good friends of mine were killed within a week through no other reason than an excess of zeal for "pressing on." They were all ex-R.A.F. with operational experience. Their one weakness was that they *Knew*.

The women pilots in A.T.A. did not ask for any praise. We did not feel that we were entitled to admiration any more than the men pilots. Most of the time we worked as hard as they did, and we certainly endured any hardship or discomfort that might have occurred with equal fortitude. I think we flew our share, and if we did abandon flights due to weather conditions it was not necessarily inefficiency, it was rather because we were "Paid to be Careful, not Brave." (Your handling notes, Mr. Symondson.)

This is a controversial subject on which there will always be dissention. I have watched the correspondence developing with considerable amusement, and why the male sex should single us out for attention I am at a loss to understand. I can only assume that something must have acted as a challenge to evoke this spate of verbosity.

Could it be our efficiency?

ROSEMARY L. GIBBS,
Ex-A.T.A. Woman Pilot.

AUTOMATIC PILOTING

The Need to Meet Present Conditions

MR. MEREDITH (*Flight*, November 27th) in his reply to my letter, appears to have become somewhat confused in his gallant, but quite unnecessary defence of the Government scientific workers on instrument-landing problems. He will find nothing in my letter even suggesting that there might be complacency in their department. In fact, I rather suspect that the only reason why B.L.E.U. have not been able to achieve automatic landings, as have the Americans, is because they are held up through lack of a suitable British automatic pilot which has the characteristics of the A-12.

Mr. Meredith goes on to explain why he does not consider automatic pitch trim control and altitude control necessary, although he proposes to provide them eventually; but surely the reason he is going to do this is because the operators want them, and airline operators are not in the habit of requiring unnecessary equipment. Altitude control is extremely useful during initial approach procedure, especially when turns have to be carried out at low altitudes, and although the trim tab servo of the A-12 may not do much work on the Liberator it certainly does on the DC-6, on which I saw it demonstrated.

To state that, in the future, aircraft controls will be such that change of trim is small and air traffic control will obviate holding procedure is all very well, but unfortunately, we have to fly to-day, and are endeavouring now to maintain schedules; therefore we require an automatic pilot to meet present conditions and not the Utopia of the future.

I also cannot agree that coarse aircraft control movements are not necessary on present-day designs to follow the rather erratic and far from straight paths of S.B.A. or I.L.S. especially under cross-wind conditions with varying drift.

Mr. Meredith's attempt to belittle fully automatic landings by calling the phrase "without human control in the air or on the ground" a catch phrase, surely shows that he has not fully studied the problem. By far the majority of airline accidents to-day are due to human errors in the air or on the ground. This leads one to the conclusion that under certain conditions the pilot has too much to do, and so makes mistakes. Visualize the case of a pilot with engine trouble approaching under bad visibility conditions, anxiously watching for the break clear. Some day, without automatic pitch trim, he is going to forget to look down, check his indicating meter and trim manually. When he breaks clear very close to the ground, with a sigh of relief he will disengage his automatic pilot, only to find the stick comes smartly back and, before he can recover, his aircraft has crashed on the end of the runway. It shouldn't happen, but then aircraft shouldn't fly into high ground.

I suggest Mr. Meredith asks experienced pilots what refinements they would consider most useful in an automatic pilot. In a majority of cases, I believe the answer would be "automatic altitude control with automatic elevator trim."

"'B' LICENCE."

INTENSIVE AIRCRAFT UTILIZATION

Two Important Points Overlooked by Mr. House

AFTER reading Mr. E. T. House's article "That 3,000 Hours per Annum" published in *Flight* on November 20th, I feel that he has created a wrong impression by giving too narrow a picture, and I would like to comment on one or two points.

When Mr. House was discussing the cost involved in obtaining the maximum of work from each aircraft, he seemed to imply that night work on maintenance should be avoided. This means that aircraft will be grounded during the day for maintenance, when they could be operating. Assuming that night operations (if any) are in the minority, most of the maintenance could be carried out at night, enabling the aircraft to be ready for operations again the following morning; the extra revenue thus earned by the aircraft would surely more than compensate for the increase in cost of maintenance.

Mr. House also said that short-distance, high-frequency services will permit a higher utilization than low-frequency, long-range services. This is not necessarily true, but in any case high-frequency, long-range services will give an even higher utilization.

However, the two main points which have been missed altogether are (i) Integration of Services and (ii) Stand-by Aircraft.

Integration of Services.—Where it is necessary to operate low-frequency services over several different routes, a high utilization can only be achieved by integrating the services so that the best use is made of the aircraft.

Stand-by Aircraft.—As stand-by aircraft are necessary to ensure a reasonable degree of regularity, used intelligently they can also be made to ensure punctuality, by introducing a stand-by aircraft when a departure delay is imminent due to the late arrival of an incoming aircraft scheduled to operate that service. This allows the fullest possible utilization of the operating aircraft without sacrificing the necessary flexibility.

As to unpopular timings, is it not a fact that unless the volume of traffic warranted increasing the frequency of a particular service to such an extent that unpopular timings were avoidable, this question would not arise? Conversely, I would suggest that unpopular timings are more often the result of integrating services on too many routes at too low a frequency, to try to achieve an economic utilization.

R. E. GREEN.

FORTHCOMING EVENTS

Dec. 18th.—Royal Aeronautical Society: "The work of the High-Speed Tunnel." Prof. A. Thom, M.A., D.Sc., and W. G. A. Perring, F.R.Ae.S.
Jan. 5th.—R.Ae.S. (Derby): "Aircraft Photography." John Yoxall.
Jan. 6th.—R.Ae.S. (Belfast): "Some Experiences in Experimental Gliding." Prof. Hill, M.C., M.Sc., M.I.Mech.E., F.R.Ae.S.
Jan. 7th.—R.Ae.S. (Southampton): "Rotating Wing Aircraft." C. G. Pullin.
Jan. 7th.—British Interplanetary Society: "The Man-Carrying Rocket." R. A. Smith, F.B.I.S.
Jan. 15th.—R.Ae.S. (Gloucester and Cheltenham): Film on Rocket Flight.
Jan. 24th.—Helicopter Association of Gt. Britain: Lecture by H. M. Yeatman, M.A., A.F.R.Ae.S.

SERVICE AVIATION

AIRFIELD PROTECTION: R.A.F. Regt. armoured car patrolling the Mosquitoes of No. 140 Wing at Gutersloh airfield in Germany.

Award

THE King has been graciously pleased to approve the award of the **George Medal** to *F/O. Victor McNabney, R.A.F.V.R. (Training Branch), No. 203 Gliding School, Air Training Corps.*

The citation reads:—

On July 16th, 1947, a glider, piloted by Mr. R. A. Glass, an instructor attached to No. 203 Gliding School, crashed on a hillside in an inaccessible part of the Downhill gliding site near Coleraine in Northern Ireland, seriously injuring the pilot. In the early stages of the rescue work, the main rescue party, which included F/O. McNabney, could not approach the wreckage beyond a point about fifty feet above it. Flying Officer McNabney was lowered by a rope to the wreck, where he made the pilot comfortable. The rope was then used in an attempt to lift Mr. Glass up to the main party.

Whilst this was in progress, F/O. McNabney climbed up, in darkness, alongside Mr. Glass, who was unconscious, shielding him from bruising, and holding him out of the stream of a waterfall. After 30 feet of this climb had been achieved, further rescue gear became available. While attempting to adjust this on Mr. Glass, F/O. McNabney fell back to a ledge where he lay unconscious for approximately 30 minutes. Had he landed only a few feet away, he would have fallen a further 300 feet, on one side, or into the path of the waterfall on the other, where he might have been drowned while unconscious. When F/O. McNabney regained consciousness, Mr. Glass was dead and no further help could be given to either of them. F/O. McNabney was stranded on a ledge washed by the waterfall until rescued next morning.

F/O. McNabney was born in Armagh, Northern Ireland.

Royal Air Force and Naval Aviation News and Announcements

Three Additions to Roll

THE Battle of Britain Roll of Honour in Westminster Abbey was withdrawn from public view from December 13th to December 18th inclusive to add three names.

These were the names of the crew of a Hudson of No. 220 Squadron, Coastal Command, which left the R.A.F. Station at Thornaby on August 1st, 1940, on an operational sortie. Returning to the station, the machine flew into overhead electric cables and bombs on the aircraft exploded.

Representations were made to the Air Ministry that the names of the crew should be included in the Roll of Honour. The case had been regarded at the time as a flying accident, but it was established after further investigation that the aircraft had been on an operational sortie and that those killed should be regarded as battle casualties.

The names of the crew are: F/L. H. W. A. Sheahan, P/O. C. J. Allsup and Sgt. S. Smith, Wireless Op/Air Gunner.

Appointment

AIR COMMODORE LEONARD THOMAS PANKHURST, C.B.E., is to become Director of Command and Staff Training at the Air Ministry on January 5th next in succession to Air Commodore T. N. McEvoy, who has been selected

GLIDING IN GERMANY; A Grunau Baby at the B.A.F.O. Gliding Club at Scharfoldendorf in Germany. The Baby is a single-seater secondary type with a minimum sinking speed of just over 2½ ft. per sec.

Service Aviation . . . . .

to attend the 1948 course at the Imperial Defence College.

Air Commodore Pankhurst has been attending the Imperial Defence College this year. He has been in the Royal Air Force since 1925 and graduated at the R.A.F. Staff College in 1938.

Bogota Actors Aid Fund

A CONTRIBUTION of £85 9s 4d has been received by the R.A.F. Benevolent Fund from the Bogota Players, of Bogota, Colombia.

R.A.F. Cricket Association

THE annual general meeting of the R.A.F. Cricket Association will be held on January 16th at 2.30 p.m. in Room 207, Air Ministry, Adastral House, Kingsway, London, W.C.2.

Olympic Bobsleigh Team

G/C. R. COLLINGS, D.S.O., will lead an R.A.F. team in the Olympic bobsleigh races. Other members will be W/C. Cole and W/C. Gadd, both D.S.O.s.

Singapore R.A.F.A.'s First Dance

NEARLY 400 members and guests attended the first dance of the Singapore branch of the Royal Air Force Association, held in the Singapore Volunteer Corps' Mess, Beach Road. Membership of the association is open to serving personnel as well as ex-members of the R.A.F. and W.A.A.F., and the dance was organized by a committee under the chairmanship of Air Commodore G. P. H. Carter, Air Officer Commanding, R.A.F. Base, Seletar, the music being played by the R.A.F. Seletar Dance Band. Members of the W.A.A.F. from Changi, at the eastern end of the island, attended.

Hunt Thanks R.A.F.

IN appreciation of No. 1 Officers' Mess of the Royal Air Force station at Bicester, Oxfordshire, allowing the Bicester and Warden Hill Hunt the use of the Mess for their annual Hunt Ball, the committee has given £50 to the Royal Air Force Benevolent Fund.

STATION COMMANDER: Wing Officer N. Dinnie who is now commanding the W.A.A.F. depot at Hawkinge in Kent.

Search for "Missing" in Turkey

ARRANGEMENTS have been made with the Turkish Government for the entry of a R.A.F. Missing Research team into Turkey. Negotiations have been completed through the British Embassy in Ankara, and Group Captain E. F. Hawkins, D.S.O., head of the R.A.F. Search Service in Europe, has recently returned from there after making the final arrangements.

During operations in the Dodecanese Islands and over the Aegean, many R.A.F. aircrew were reported missing and their bodies now lie buried in widely scattered areas along the west coast of Turkey and in the Dodecanese.

The search will be undertaken by the team from Greece, which has nearly completed its task, and will be led by Squadron Leader Anthony Browne, D.F.C. Headquarters will be at Izmir and from there the difficult task of tracing and identifying the bodies of R.A.F. fighter and bomber crews lost in the vast area of the Dodecanese will begin. After identification the bodies will be re-buried in a British war cemetery in Turkey, the location of which has not yet been decided. The Turkish Government have offered either to give up a corner of one of their own cemeteries for this purpose or to hand over a small piece of their territory, where the British flag will fly.

Since early in 1945, R.A.F. Missing Research teams have "searched" from the most northern tip of Norway to Italy and North Africa and many of these teams are still operating in various parts of Europe.

LANCASTRIAN ARCTIC FLIGHT

BY penetrating the Arctic Circle to a point 450 miles from the geographical pole recently, a R.A.F. Lancastrian from the Empire Air Navigation School at Shawbury has laid the foundation of a project designed to develop a safe navigation technique for polar flying. The flights of *Aries I* over the magnetic and geographical poles in 1946 provided valuable data on problems encountered in Arctic conditions, but the recent flight was intended to be a forerunner of a scheme to make polar flying a permanent part of the training syllabus of the specialist navigation courses at Shawbury. It will probably be followed by a flight of several training aircraft deep into the Arctic Circle, thus giving experience to a large number of navigators as well as pilots and other aircrew.

The Lancastrian ("J" for "Johnnie") was crewed by the staff of the E.A.N.S. and the flight was commanded by the chief instructor W/C. R. S. J. Edwards, D.F.C., with S/L. R. G. Churcher, D.S.O., D.F.C. and Bar, as captain of the aircraft and co-pilot. The flight was intended to establish an effective polar navigation drill using standard equipment; to collect information on signals and meteorology for future Arctic flights; to further the technique of steering aircraft without magnetic compasses; to investigate Arctic phenomena; to collect information on long-range radio aids and pressure pattern flying.

Flying via Prestwick to Keplavik, an airfield 20 miles from Reykjavik, Iceland, the Lancastrian took off for the Arctic journey at 1 a.m. (G.M.T.). Flying north across the Denmark Strait the Aurora Borealis lay ahead, a green arc across the sky, not very bright because of the full moon, but as the crew neared Greenland they left the Aurora astern. After crossing the coast and flying some distance into Knud Ramussen's Land they turned WNW to pass over the only sign of life on the trip, the faintly flickering lights of the small settlement and meteorological station at the mouth of Scoresby Sound. The Sound looked magnificent in the brilliant moonlight.

82 deg 30 min North

They then turned to the north and flew parallel with the Greenland coast and some 50 miles east of it, first over a wide belt of the coastal loose pack ice and then over the permanent icefields, which they encountered about the 75th Parallel. Flying still north at 12,000ft, the height maintained throughout the trip, the Lancastrian finally turned when in the position 82° 30′ N., 05° 00′ E. at 8 a.m. This point is parallel to, and to the east of, Peary Land, the most northern point of Greenland, and about 200 miles north of Spitzbergen. It then turned south and flew back on a track somewhat to the east of its outward course until abreast of Scoresby Sound, where it set course for Keplavik, touching down at 1.30 p.m. It had flown 2,570 nautical miles (2,959 statute miles) in 12½ hours.

The weather was ideal, and although the crew were cold several of them had experienced more discomfort on operations at 20,000ft over Germany. The lowest temperature recorded was −27 deg Centigrade. For most of the time they flew in darkness, the polar night being permanent from November to March above the 75th Parallel. Never once did they fly in cloud, but there was a "white haze" over the icefields and on the northern part of the trip the cloud tops were at about 1,000ft. None of the crew had previous experience of polar flying. They found it very exhausting, as the automatic pilot was not used for most of the flight. Oxygen helped considerably in keeping them warm. They carried sandwiches and thermos containers of coffee, and Arctic survival kit was supplemented by rifles, which might have been useful in the event of a forced landing, in providing food. No unexpected or unusual behaviour by instruments was experienced; the aircraft was too far from the magnetic pole for the compasses to undergo the strange reactions noticed by the *Aries I* in that region. Navigation techniques employed during the flight were the grid technique—Mercator charts being useless in northern latitudes—and pressure pattern flying as an aid to astro-navigation. Both techniques can, of course, be used at any latitude, but they are essential in polar regions.